WIRE
& WIRE PRODUCTS

OFFICIAL PUBLICATION OF THE WIRE ASSOCIATION

February 1932

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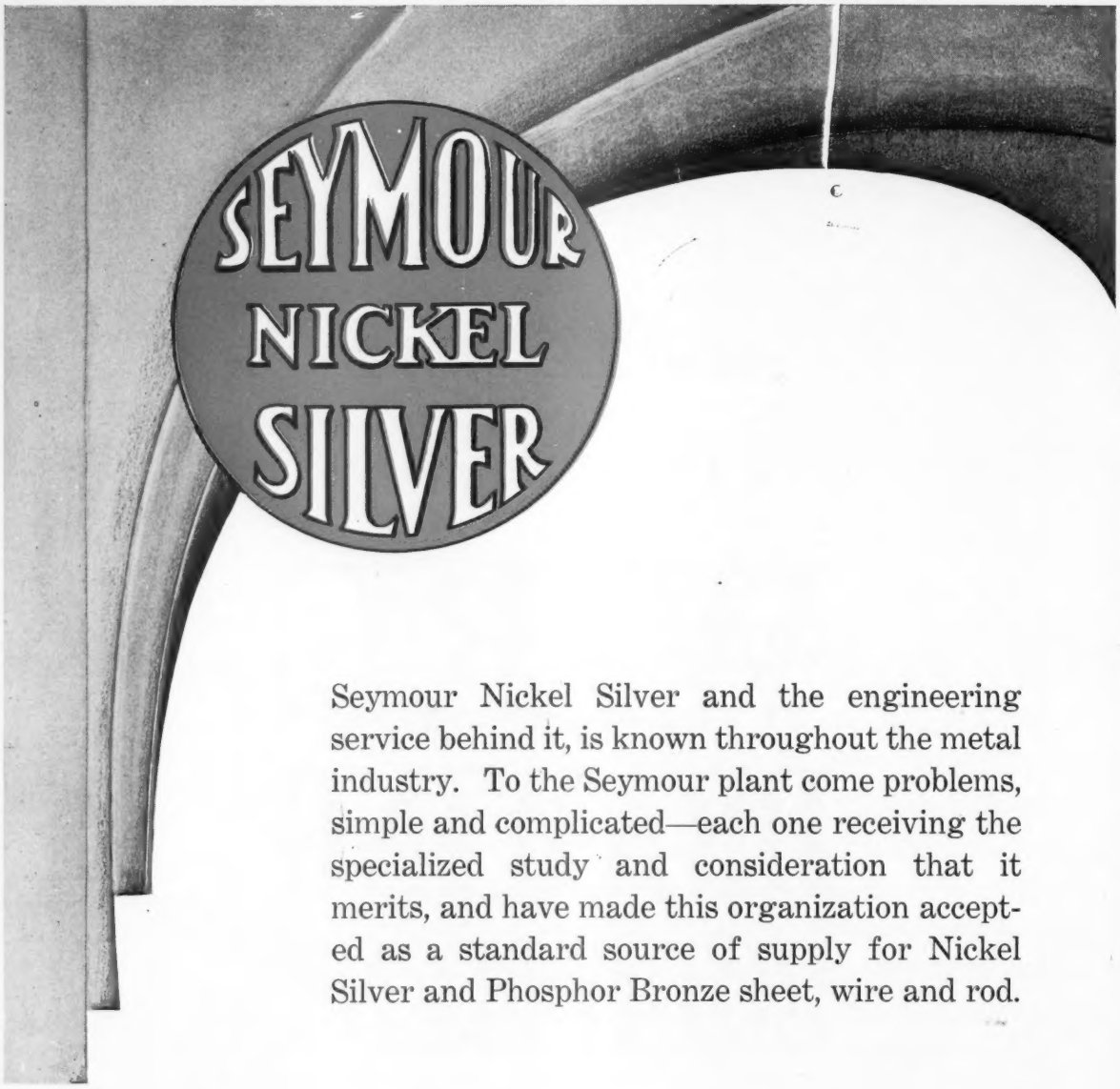

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Seymour,
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1878 S 1932

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A monthly publication devoted to the production of Wire, Rod and Strip. Wire Products and Insulated Wire and Cable.

DRAWING — ROLLING — EXTRUDING — FORMING — FABRICATING.

Vol. 7 February 1932 No. 2

Official Publication of The Wire Association

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DRAWING — ROLLING — EXTRUDING — FORMING — FABRICATING

Vol. 7 FEBRUARY, 1932 No. 2

Nickel Silver in Rod and Wire

By Richard E. Brown

An Outline of the Development of Nickel Silver together With a Description of Present Methods of Rod and Wire Production at the Plant of The Seymour Manufacturing Co., Seymour, Conn.

BEFORE attempting to outline the manufacturing practice of Nickel Silver being fabricated into Wire and Rod, it might be well to rehearse the early events in its history, as it is one of the oldest alloys known to man.

✦ ✦ ✦

METALLURGICAL History states that in 235 B. C. it was being made into coins, one of which is preserved today, and perhaps is the earliest Nickel Silver object that we have. To the Chinese can be traced the first workings of this alloy, as in Canton we find them trudging with odd rings of copper-nickel, suspended on poles, reaching from shoulders to shoulders of the carriers, to be refined with the addition of Zinc. Long caravans plodded out of southern China and made their way across India, struggled over the Hindu-Kush Mountains into Bactria, bringing a rare white metal, which they called Packfong. This was made into candle-sticks and ornamental boxes, which were sold to the old East India Company and carried to England and Germany, and prized everywhere for their beauty and their Oriental origin. Thus, out of the Far East, at great cost, came the first Nickel Silver articles.

EARLY in 1700, ship captains of the old East India Company brought to England, as part of their "privileged trade", boxes, canisters, bowls, candle-sticks—fashioned by Chinese craftsmen from a beautiful silvery-white metal. It was called by them pai-t'ung (white copper)—by the English tuteneg, toothanegg, totenars (some of the many names given the zinc-copper-nickel alloys from China)—but it was in fact Packfong, a combination of copper, nickel and zinc, equivalent to the Nickel Silver of today.

✦ ✦ ✦

A chance traveller through the queerly - peopled, secluded valleys about Schneeburg, Saxony,

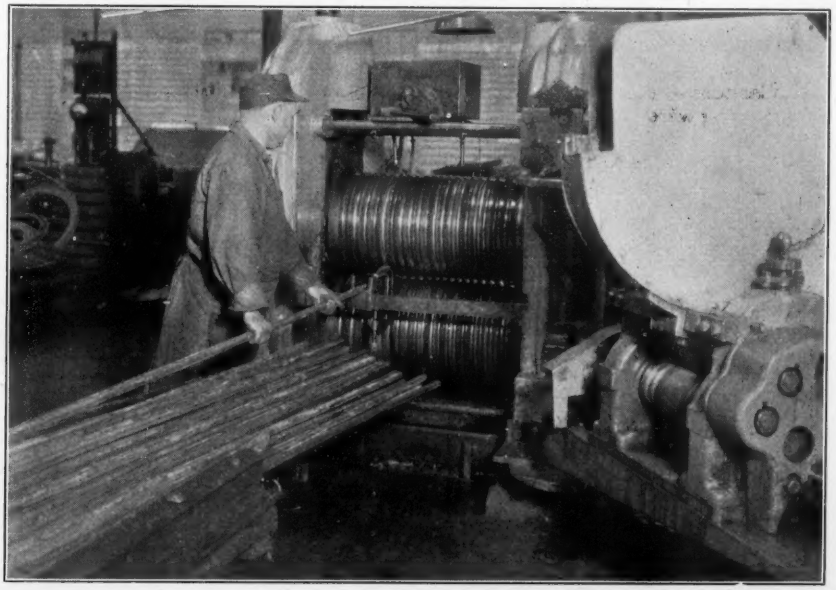

Fig. 1. Rod Rolls for Nickel Silver. The Seymour Mfg. Co., Seymour, Conn. ✦ ✦ ✦

. . . but they are *Not* the same

A COMPANY* purchased two 500,000-pound lots of .45 carbon steel wire for conversion into road mats for re-enforcing concrete roads. Allowable wire size .194/.190. One lot was drawn through chilled iron dies, the other through Carboloy dies.

OPERATING DATA

The average weight of each bundle of wire drawn was..... 375 pounds

CHILLED IRON DIES:

On the first lot, using chilled iron dies, one bundle per hole was obtained. To complete the lot required..... 1333 holes

The front end of each bundle was on size and the tail end at or close to the large size allowed. Based on the mean size of .192, weighing 99 pounds per 1000 feet, they obtained, from 500,000 pounds.... 5,050,000 feet

THE CARBOLOY DIE:

On the second lot, using a Carboloy die, no hole changes were made.

Starting at the low size of .190, the average wire size was .191, weighing 98 pounds per 1000 feet and furnishing..... 5,100,000 feet

The Carboloy die saved 1332 hole changes, made longer bundles, with a total increase of 50,000 feet of wire (9.5) miles weighing 4900 pounds, and *gave a better finish to the wire.*

These are a few reasons why the phrase: "To be drawn through Carboloy cemented carbide dies" is becoming mighty popular among wire buyers these days.

*Name on request.

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3. Superior surface finish.
4. Longer life per hole size.
5. Less rejections, less scrap and a more economical product.

might have encountered, among other less reasonable things, excited mule drivers, hurrying a new rich ore to the village furnaces. When in spite of every effort, neither silver nor copper could be obtained from it, the smelters looked askance, fumed. "Those cursed Elfin", they said, "have put upon this rich ore, the spell of "Old Nick". "It makes no kupfer, only kupfer-nikkel. Bah!" The opprobrious name stuck, even after the "spell" was found to be another metal.

✦ ✦ ✦

WITH little faith in Elfin witcheries, Axel Cronstedt roasted, melted, dissolved, precipitated the cursed Kupfer-Nikkel. With only an "iron mortar", a "conical glass", says an old account, "the inside—an oval bottom —to try acids, a vessel to put over the furnace, a fusion furnace—laid up with long pieces of charcoal, bellow, tonge", the persistent young Swede by 1751, after five fruitless years, identified a new metal—called it kupparnickel—nickel for short.

✦ ✦ ✦

Discovery of Pure Metal Nickel

IT was not until 1803 that Dr. J. B. Richter of Berlin, together with his associates, obtained a pure metal nickel. Great credit is due this thorough scientist for his arduous work, and particularly for his determination of the specific gravities, 8.278 for the ingot metal and 8.666 for the forged state . . . practically the same figures that are accepted today. With difficulty, he proved the correctness of his discoveries to many skeptical contemporaries, and in 1804 published the results of his labors in a book entitled, "Nickel—Absolutely pure. Proofs That It Is A Noble Metal. Its Preparation and Special Properties." His accuracy of analysis was indeed a great contribution.

✦ ✦ ✦

IN 1830 Herr Guitike of Berlin brought the first samples of a new compound metal to Sheffield, England, to introduce to the famous makers of "Sheffield Plate". Guitike's metal was too brittle for general use, but the interest it aroused, gave it the name of "German Silver", by which generic term all alloys of the metal were known. During the last years of the manufacture of "Sheffield Plate", German Silver was used as a foundation in place of copper by some makers, who are described in the directories of that time as "Platers on White Metal". It was some ten years later, however, that the process of electro-plating first began to develop as a successful manufacturing venture and gave impulse to the production of German Silver.

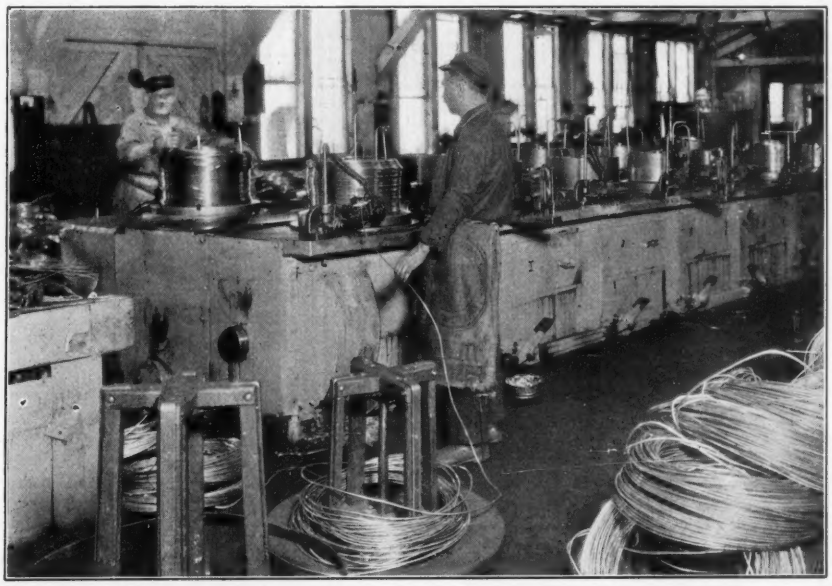

Fig. 2. Wire Drawing Blocks for Nickel Silver. The Seymour Mfg. Co., Seymour, Conn. ✦ ✦

THE name "German Silver" was used for this alloy in this country until the late war, and then, at the request of the government was changed to "Liberty Silver". After the war, the adoption of the term "Nickel Silver" was general, as it was more descriptive of the alloy, and by virtue of the fact that England was using this term for over 100 years.

✦ ✦ ✦

UNTIL the mining of nickel ore on the island of New Caledonia got well under way, nickel ore was sought for all over the world. Today the general source of supply for this country is Canada.

Nickel Silver

NICKEL Silver is essentially an alloy of copper and zinc, usually in a ratio of about two to one, with which has been incorporated a percentage of Nickel. The Nickel serves as a determinant of the grade, which runs from 5% to 30%, of which 18% is by far the most popular. The 18% Nickel content gives the alloy a more silvery appearance than the lower or higher Nickel contents, and is manufactured in various forms, such as sheet, wire, rod, tube, shells, and ingots. It being a strong, ductile alloy, it can be worked cold, drawn, rolled, hammered, or spun. A very silvery lustre is obtained when polished, but like any high grade metal, must be kept clean to retain its brilliancy. It will not turn brassy, however, as it is the same color throughout. It can be annealed at any working point to reduce the crystalline hardness caused by continual working, or to produce a special temper.

The uses for this alloy, are numerous and varied. The largest tonnage is manufactured in sheet stock for the Table Cutlery, Hardware and Novelty Trades, but a considerable quantity is made into

(*Please turn to page 58*)

Graphic Methods For Determining Percentage Reduction of Area of Round Rods*

By L. W. Luff, Met. Eng.

Research Assistant The International Nickel Co. Inc., Huntington Works

IN the production of cold drawn rods and wire the problem of specific tempers for specific applications has become increasingly important. The production of the various tempers in many cases has been based on definite reduction in area expressed either in gauge numbers drawn or as a percentage reduction of original area. This latter calculation, that of percentage reduction of the original area, is of necessity more generally applicable; but is somewhat tedious when frequuently repeated. Fortunately it lends itself readily to graphic solution and presentation which allows charts to be utilized by the mill operators, even though they may not be specially trained in mathematical computation.

✦ ✦ ✦

Graphic Solution of Problems

THIS paper presents a graphical solution of the three cases occurring in this problem: (a) the computation of reduction in area when the original and final diameter of the material are both known; (b) the original diameter necessary to produce any final diameter for a definite percentage reduction in area; and (c) conversely the final diameter produced by applying a definite percentage reduction in area to any original diameter.

✦ ✦ ✦

Construction of Chart

THE Chart of Fig. 1, Constructed after Lipka[2] has been plotted with the actual areas for each diameter as ordinates and abscissas designated as the corresponding diameters.

(2) Joseph Lipka—Graphical and Mechanical Computation, Page 35—John Wiley and Sons, Inc., New York 1918.

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TABLE I

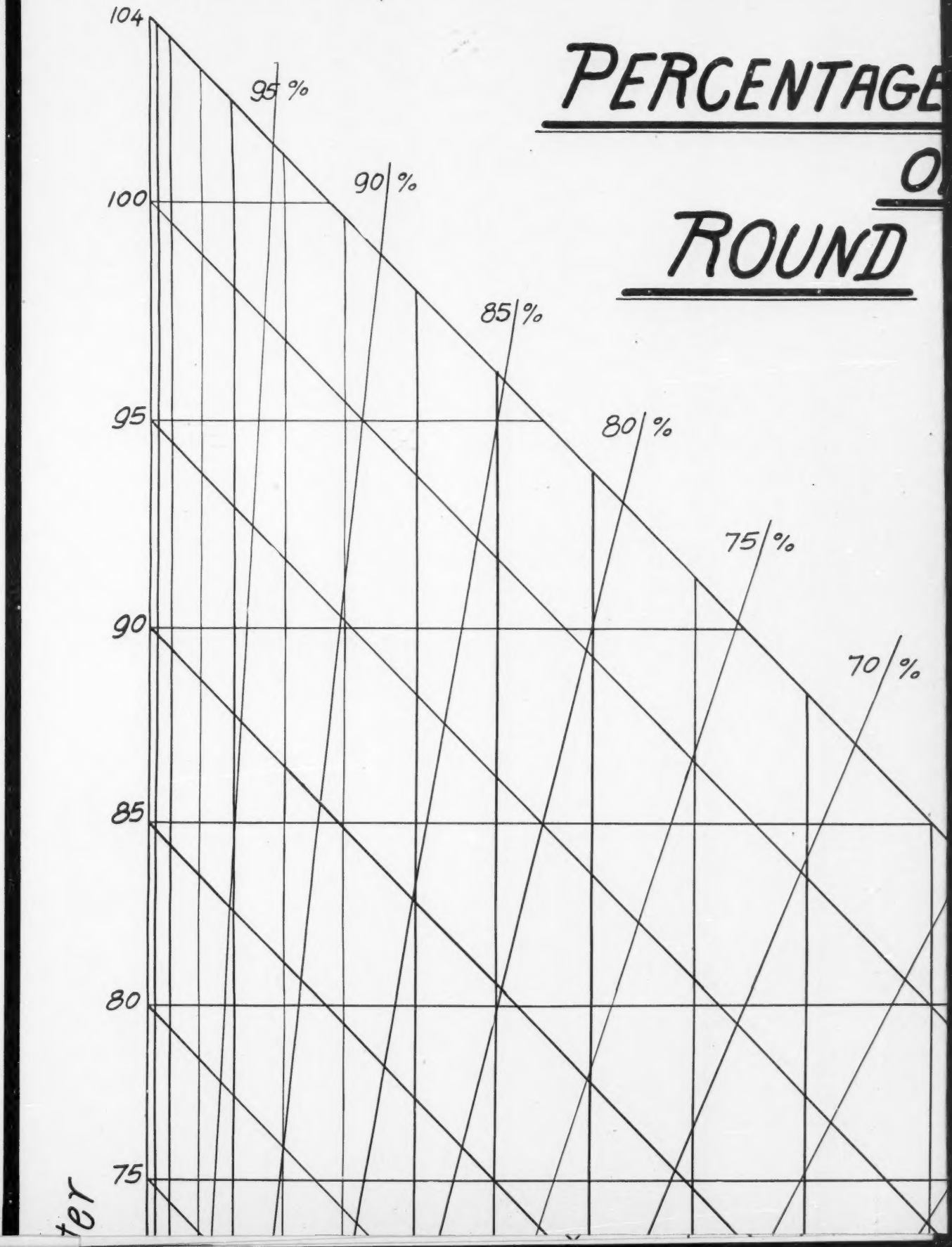
Multiplication Factors For Obtaining Original Diameters From Final Diameters—See Fig. 2

For	5%	Reduction	multiply	final	diameter	by	1.026
"	10%	"	"	"	"	"	1.053
"	15%	"	",	"	"	"	1.083
"	20%	"	"	"	"	"	1.117
"	25%	"	"	"	"	"	1.156
"	30%	"	"	"	"	"	1.193
"	35%	"	"	"	"	"	1.241
"	40%	"	"	"	"	"	1.291
"	45%	"	"	"	"	"	1.352
"	50%	"	"	"	"	"	1.412
"	55%	"	"	"	"	"	1.492
"	60%	"	"	"	"	"	1.584
"	65%	"	"	"	"	"	1.693
"	70%	"	"	"	"	"	1.833
"	75%	"	"	"	"	"	2.000
"	80%	"	"	"	"	"	2.230
"	85%	"	"	"	"	"	2.573
"	90%	"	"	"	"	"	3.180
"	95%	"	"	"	"	"	4.375

TABLE II

Multiplication Factors For Obtaining Final Diameters From Original Diameters—See Fig. 3

For	5%	Reduction	multiply	original	diameter	by	.9747
"	10%	"	"	"	"	"	.9497
"	15%	"	"	"	"	"	.9234
"	20%	"	"	"	"	"	.8953
"	25%	"	"	"	"	"	.8658
"	30%	"	"	"	"	"	.8382
"	35%	"	"	"	"	"	.8058
"	40%	"	"	"	"	"	.7748
"	45%	"	"	"	"	"	.7396
"	50%	"	"	"	"	"	.7082
"	55%	"	"	"	"	"	.6702
"	60%	"	"	"	"	"	.6313
"	65%	"	"	"	"	"	.5907
"	70%	"	"	"	"	"	.5456
"	75%	"	"	"	"	"	.5000
"	80%	"	"	"	"	"	.4484
"	85%	"	"	"	"	"	.3886
"	90%	"	"	"	"	"	.3145
"	95%	"	"	"	"	"	.2286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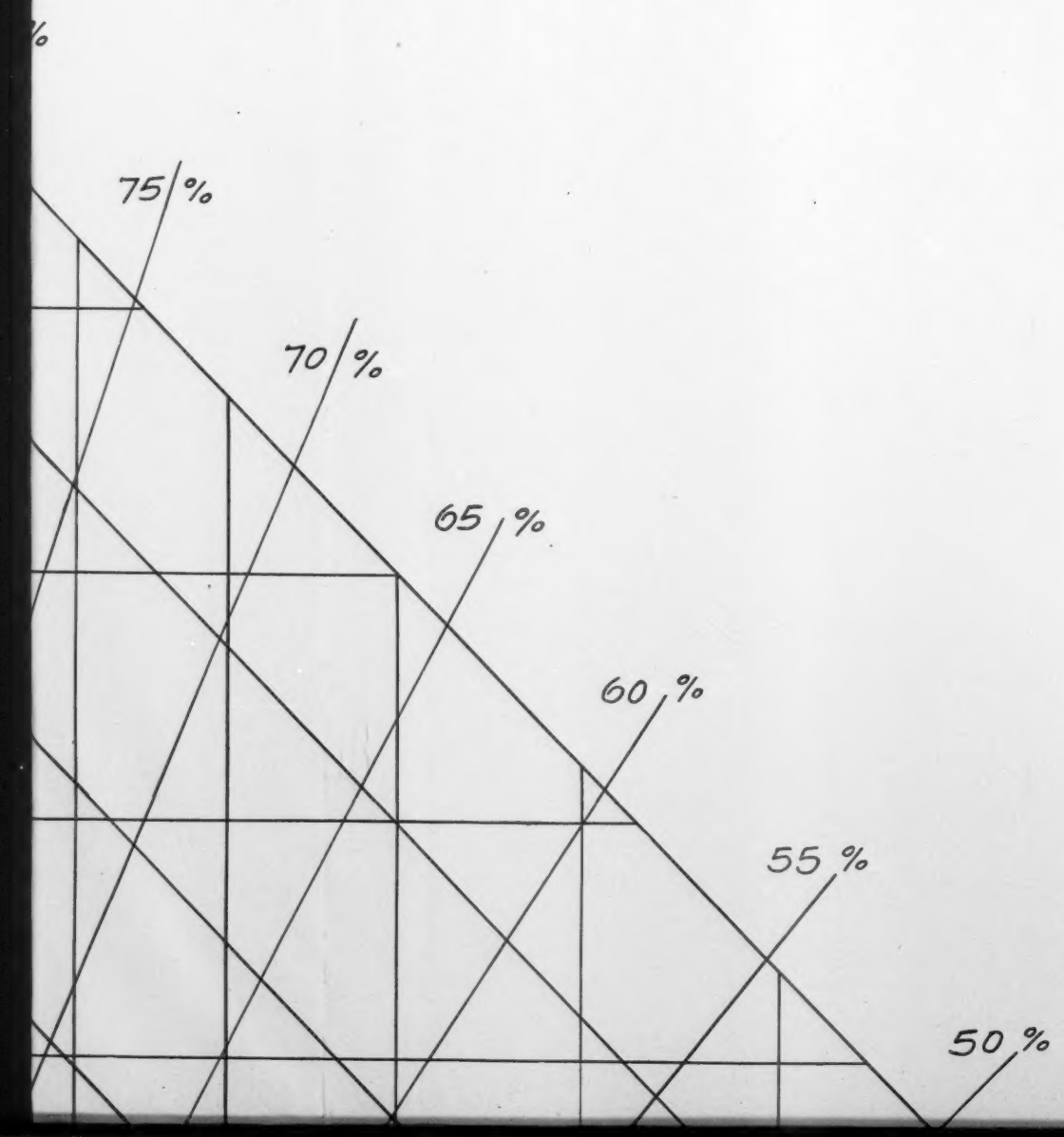

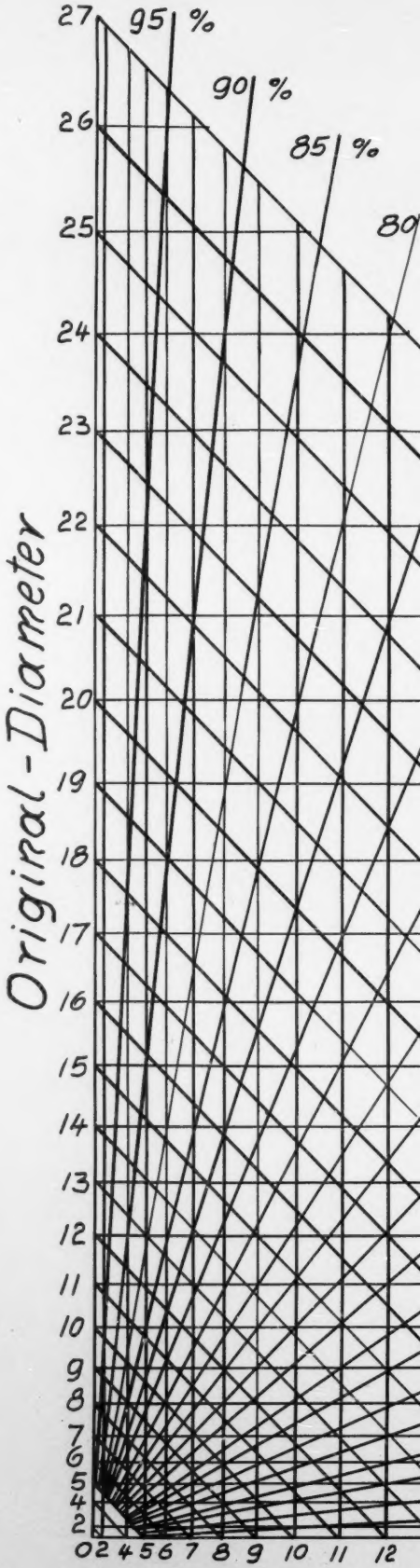

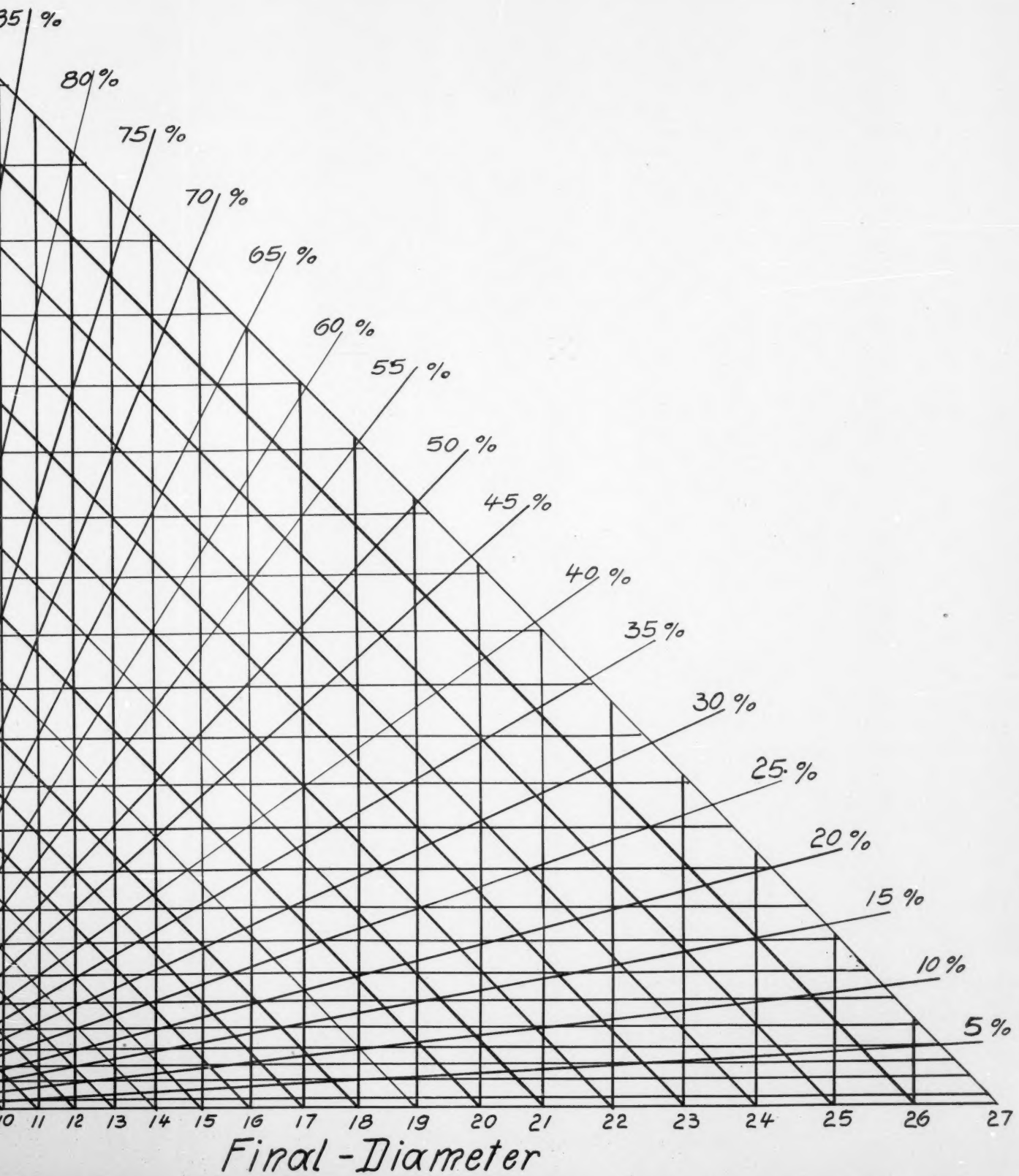
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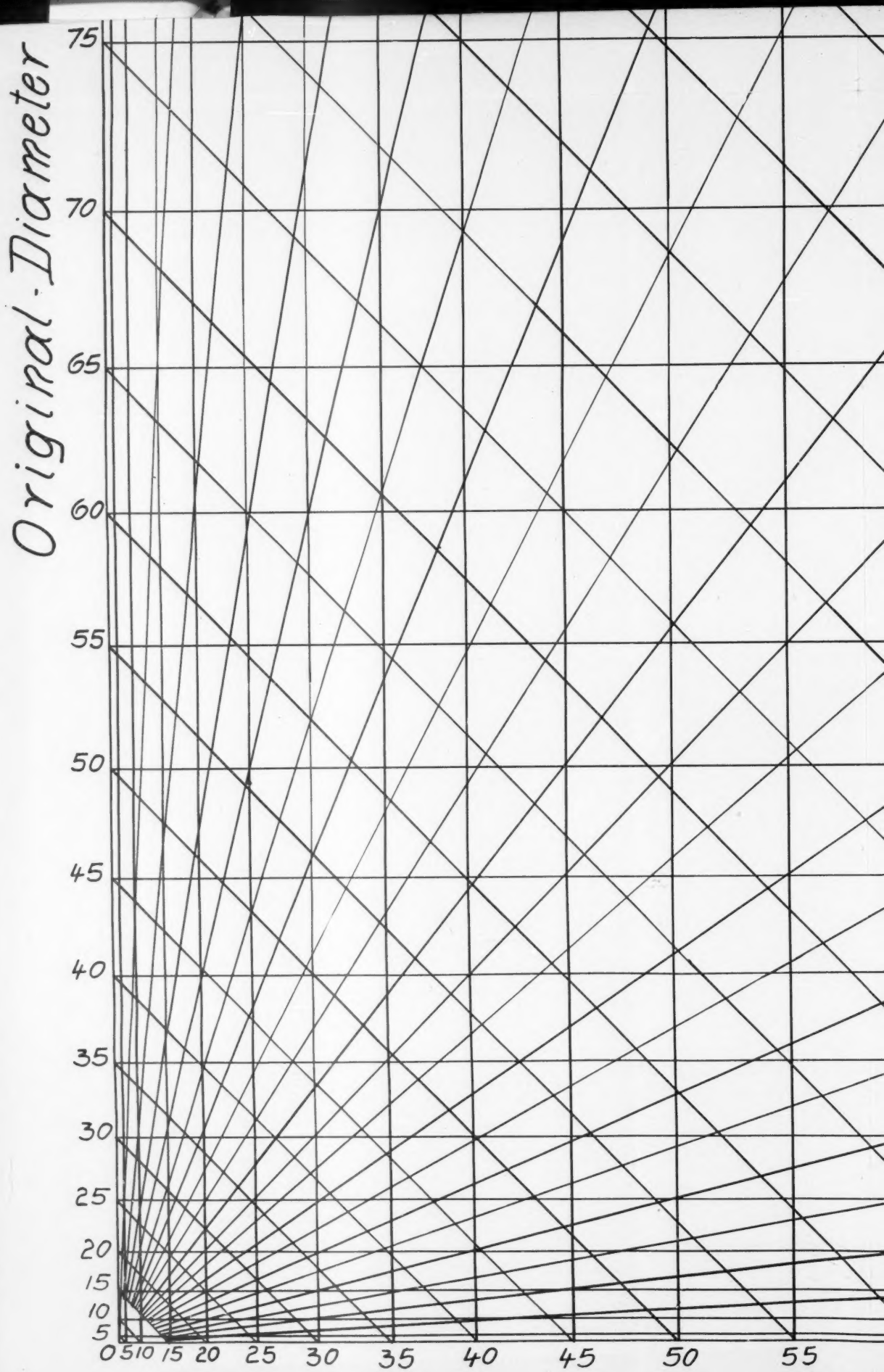

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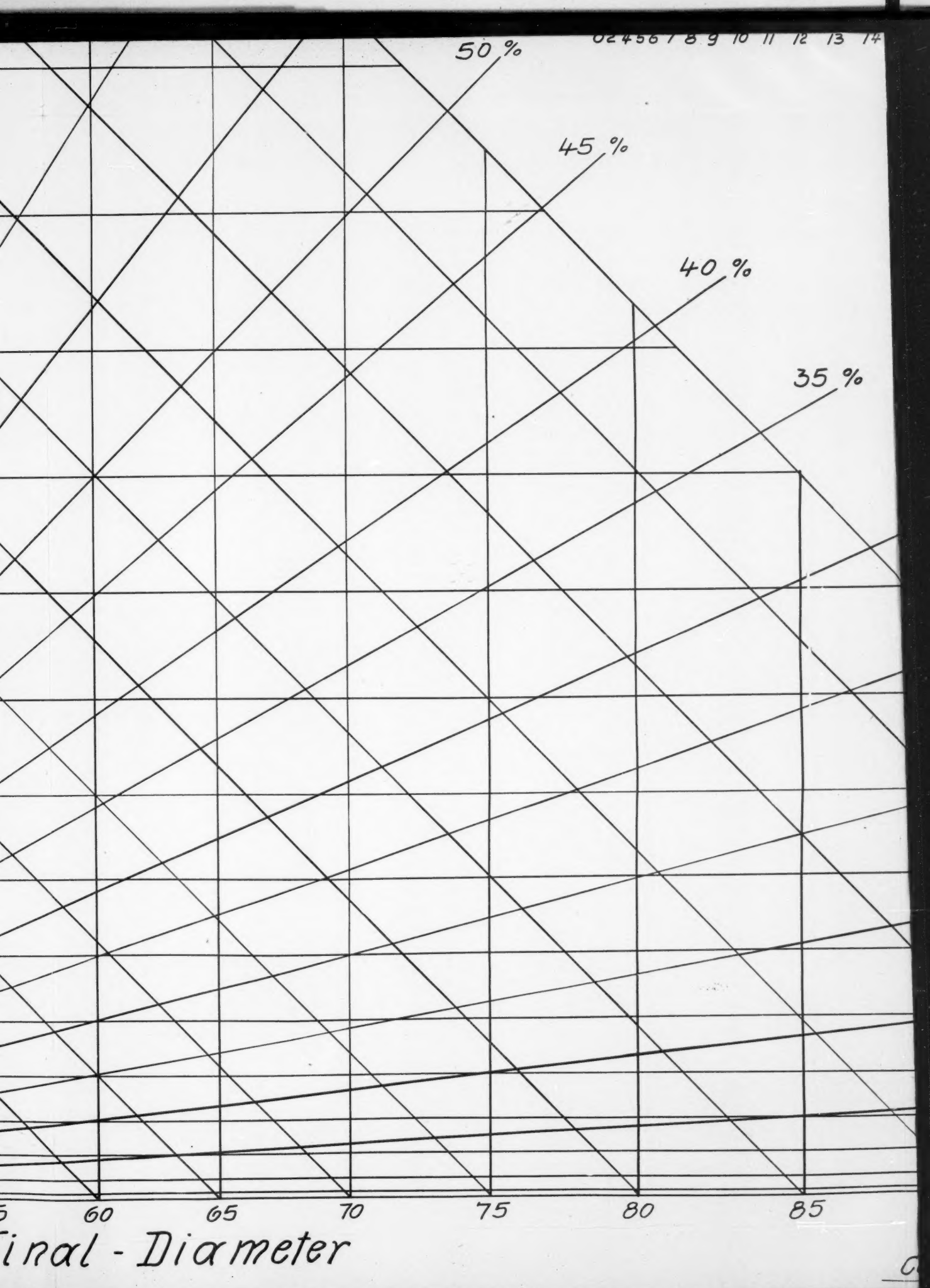
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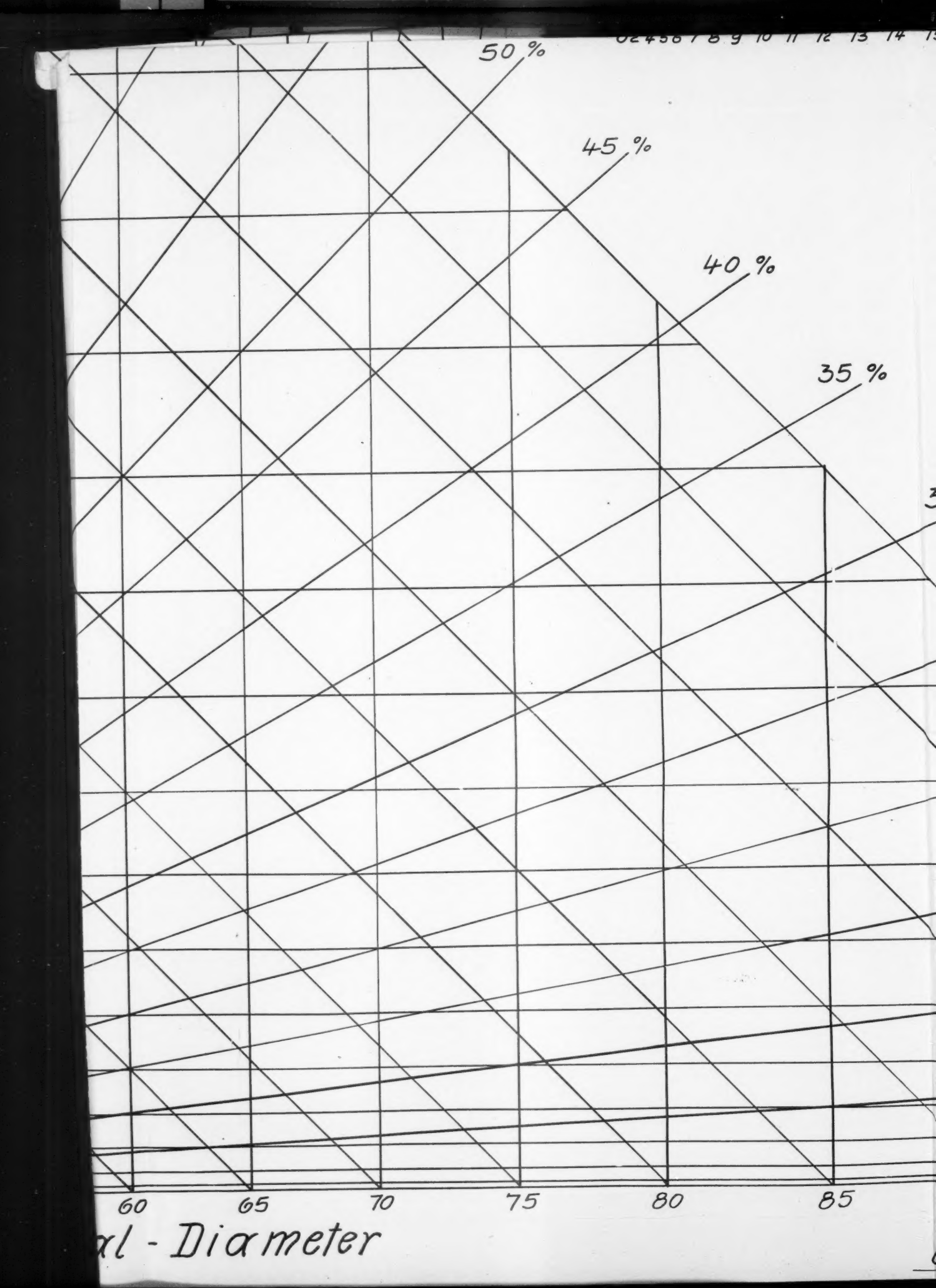
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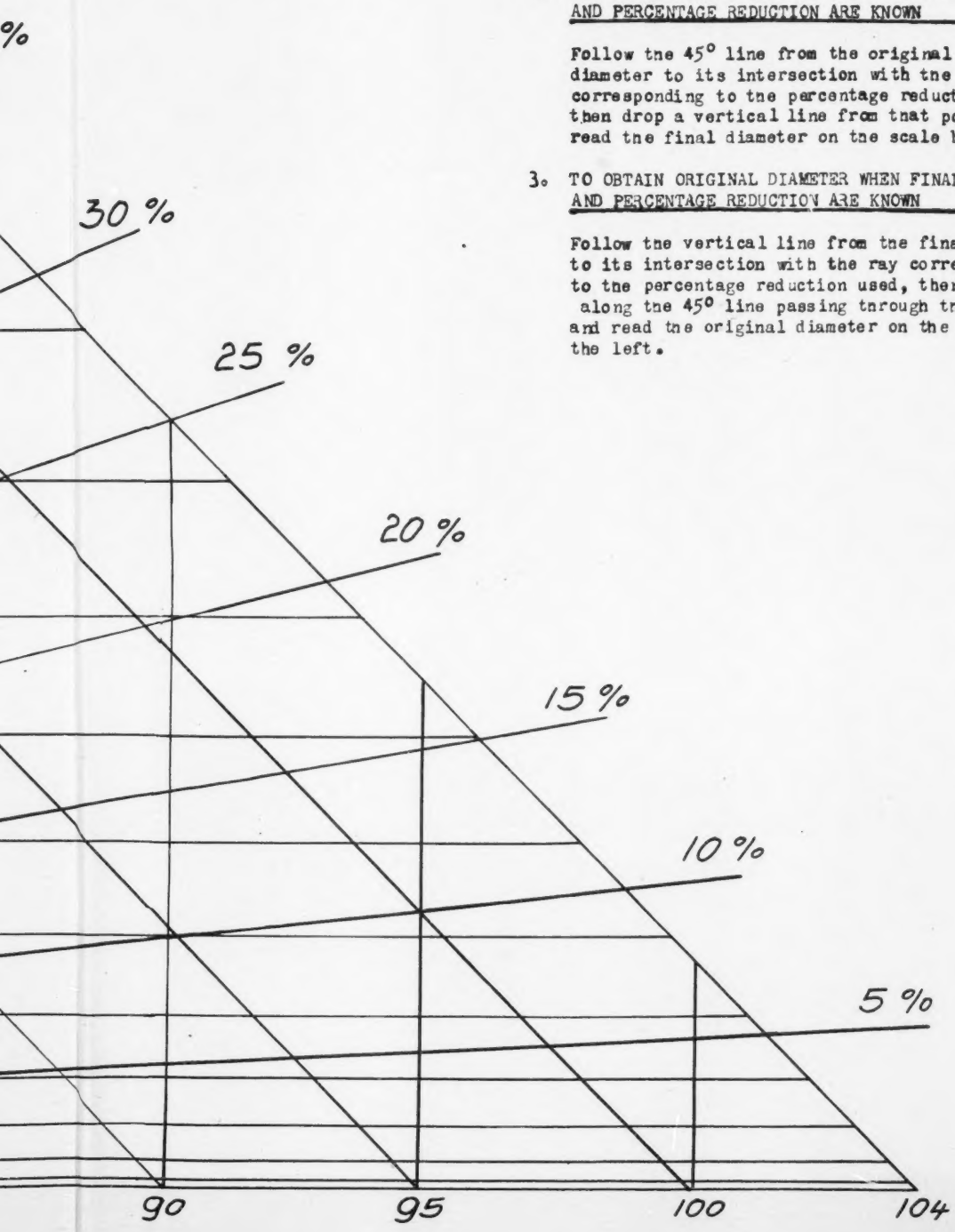

INSTRUCTIONS

1. TO OBTAIN PERCENTAGE REDUCTION WHEN ORIGINAL AND FINAL DIAMETERS ARE KNOWN

   Follow the 45° line from the original diameter to its intersection with the vertical line from the final diameter, and read the percentage reduction on the ray passing through that point from the origin.

2. TO OBTAIN FINAL DIAMETER WHEN ORIGINAL DIAMETER AND PERCENTAGE REDUCTION ARE KNOWN

   Follow the 45° line from the original diameter to its intersection with the ray corresponding to the percentage reduction used, then drop a vertical line from that point, and read the final diameter on the scale below.

3. TO OBTAIN ORIGINAL DIAMETER WHEN FINAL DIAMETER AND PERCENTAGE REDUCTION ARE KNOWN

   Follow the vertical line from the final diameter to its intersection with the ray corresponding to the percentage reduction used, then follow along the 45° line passing through that point and read the original diameter on the scale at the left.

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The insert table of this figure expands the crowded section from zero to 25 to facilitate reading. The threefold use of the chart is tabulated below:

✦ ✦ ✦

(1) To obtain percentage reduction when original and final diameters are known, follow the 45° line from the original diameter to its intersection with the vertical line from the final diameter, and read the percentage reduction on the ray passing through that point from the origin.

✦ ✦ ✦

(2) To obtain final diameter when original diameter and percentage reduction are known, follow the 45° line from the original diameter to its intersection with the ray corresponding to the percentage reduction used then drop a vertical line from that point, and read the final diameter on the scale below.

✦ ✦ ✦

(3) To obtain original diameter when final diameter and percentage reduction are known, follow the vertical line from the final diameter to its intersection with the ray corresponding to the percentage reduction used, then follow along the 45° line passing through that point and read the original diameter on the scale at the left.

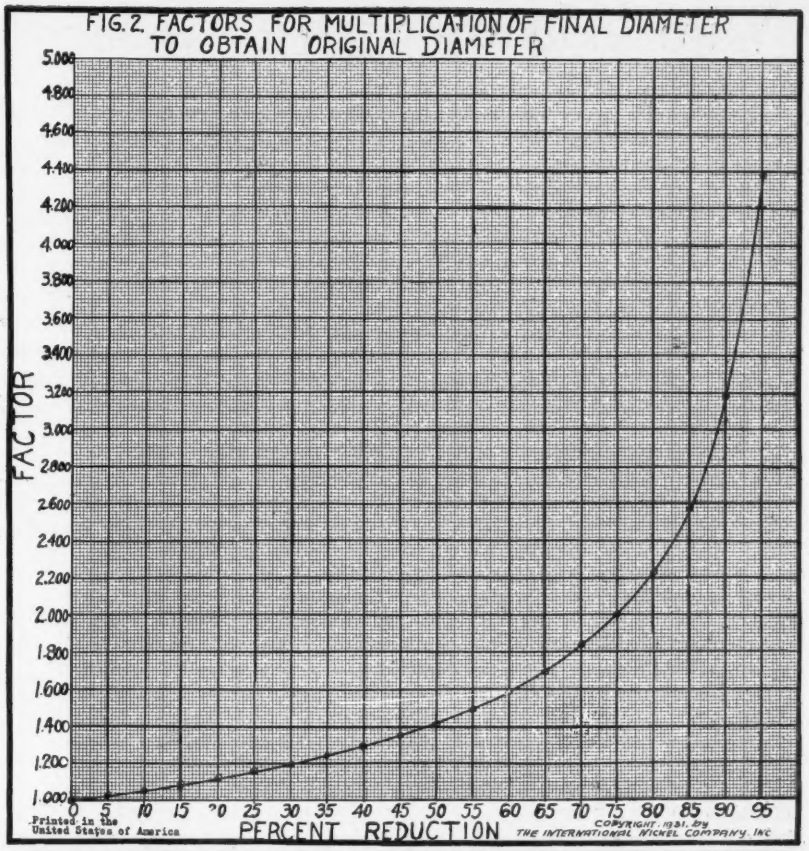
✦ ✦ ✦

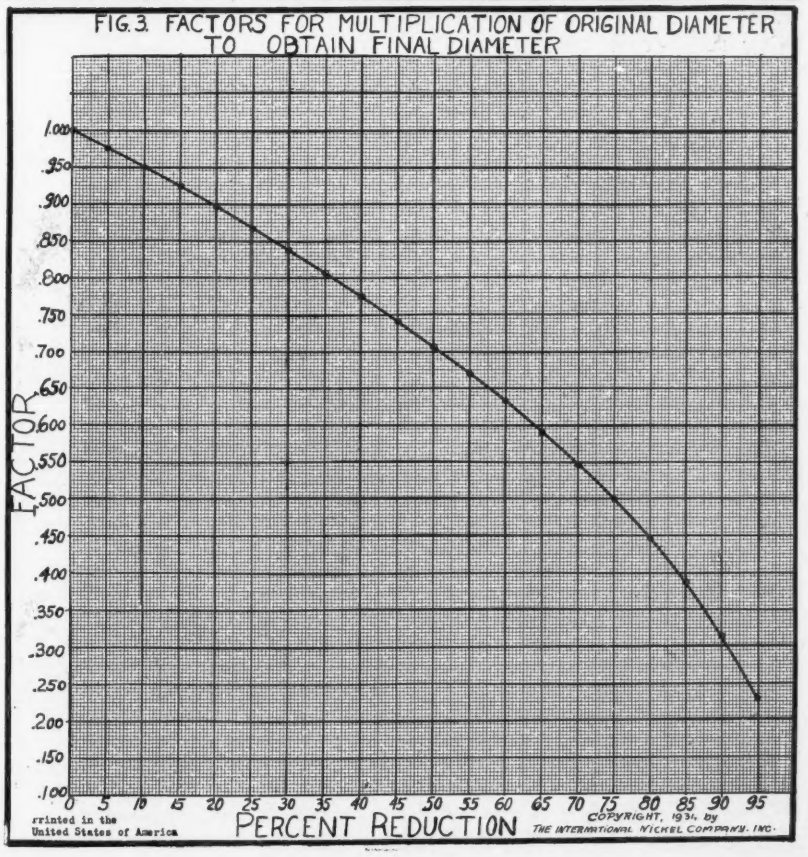
A straight edge or desk rule is useful in interpolation of this chart for diameters and reductions which are not shown.

✦ ✦ ✦

Figures 2 and 3 Plotted From Data Of Tables I and II

Figures 2 and 3 respectively show curves of multiplication factors for obtaining original diameters from final diameters, and final diameters from original diameters for any percentage of reduction. These curves are plotted from the data of Tables I and II, which show factors for intervals of 5 percent reduction in area. The factor curves of Figures 2 and 3 are essential in cases where the observed points lie outside the limits of the chart.





Wire Industry Vital to Industrial War Planning

By Frank W. Bullock
1st Lieut. Signal Corps, U. S. Army
Chairman of War Department Commodity Committee on Wire and Cable of the Office of the Assistant Secretary of War.
(Member of the Wire Association)

An Address Delivered Before the Wire Association Outlining the Authority and Need for Industrial War Planning During Times of Peace.

The Wire Industry is of Vital Importance in Such Planning Because Wire in Some Form Enters Into the Fabrication of Every Item of Military Equipment and Communication Systems. ▼ ▼ ▼ ▼ ▼ ▼ ▼ ▼

FROM the earliest dawn of civilization, experience has demonstrated that no individual, community, or nation, can at one and the same time, be rich, weak, and safe.

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GRANTING that this assertion is true, what has it to do with The United States of America, in this year of peace, 1931? Is not our population large, strong and virile? Do we not possess nearly half of the material wealth of the world? Are not our farms, our mines, our factories and our institutions of trade more productive and efficient than those of other nations? Is not our standard of living the marvel and envy of the world? Surely we have these things! Why then is this nation not both strong and safe as well as rich, since we are possessed of the greatest military resources in the world? Let us consider a moment—do we deliberately allow our car to stand unlocked on the street—or permit our fire insurance to lapse? Of course there is no indication that the car will be stolen today or a year from today or that our house will take fire, and if these things did happen, its more than probable that the damage would be small—so why worry. And quite rightly, we don't worry—we protect our property—and remove the cause for worry.

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SIMILARLY, we do not expect our country to be menaced by war today or a year from today, but do we for that reason fail to provide ourselves with adequate protection against the possibility of such an event? No! Realizing that military resources and military strength are not synonymous terms, we have by legislative enactment, made National Defense a primary function of government, in which every citizen has a definite responsibility.

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OUR conception of National Defense as enacted into law, differs both in theory and practice, from national armaments as maintained in the Old World. For protection against civil disorders, for the assurance of safety to our sea borne commerce, and for defense against foreign aggression, we visualize the employment of armed forces created by the people, from the people, and answerable to the people.

FRANK W. BULLOCK
1st Lieut. Signal Corps, U. S. Army
Chairman of War Department Commodity Committee on Wire and Cable of the Office of the Assistant Secretary of War.
(Member of the Wire Association)

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THE translation of this conception of national defense into terms of effective armed forces has, throughout our entire history, encountered serious obstacles, geographical, political and psychological. To be specific, our country is comparatively remote from the disturbing influences of foreign politics, and, protected as we are by two oceans, the menace of foreign aggression is not an immediate one. Furthermore, our states are entirely independent, self-governing sovereignties, jealous of their independence, and reluctant to concede great power even to a self-created federal government. And finally, there has always been, as now, in the minds of a majority of our people, a deep seated aversion to large standing defense forces.

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THE constitution, in placing upon the federal government the responsibility of "providing for the common defense", invested the several departments thereof with certain definite powers and limitations. To the Congress was delegated the power:

"To declare war, grant letters or marque and reprisal and make rules governing captures on land and water."

"To raise and support armies, but no appropriations of money to that use shall be for longer than two years."

"To provide and maintain a navy."

"To provide for calling forth the

militia to execute the laws of the Union, suppress insurrections and repel invasions."

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OTHER powers and responsibilities relating to the "common defense" were vested in the executive department.

"The President shall be Commander in Chief of the Army and Navy of the United States and of the Militia of the several states when called into the actual service of the United States; * *."

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THAT the final responsibility for national defense rests with the individual citizen, is given positive expression in the second amendment to the Constitution, which says:

"A well regulated militia being necessary to the security of a free state, the right of the people to keep and bear arms shall not be infringed."

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LET us consider briefly how these broad powers have been exercised. Realizing that while providing the means for national defense is exclusively a legislative function, the control and employment of such means when provided is an exclusively executive responsibility, Congress, on Aug. 7, 1789, by joint desolution created the Department of War, headed by a civilian, operating under the executive authority of the President, as a cabinet minister. But having created a War Department, our pioneer legislators discovered that there was no establishment for it to administer, since the only armed forces then existing were those of the states. In 1790, therefore, Congress adopted what may be termed our first "National Defense Act", which authorized the President to employ for a term "not exceeding six months * * * a corps not exceeding two thousand noncommissioned officers, privates, and musicians, with a suitable number of commissioned officers."

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TWO years later, an act, "More effectually to provide for the national defense, by establishing an uniform militia throughout the United States," was passed. It provided—among other things:—

"That each and every free, able bodied white male citizen of the respective states, resident therein, who shall be of the age of eighteen years, and under the age of forty-five years * * * shall severally and respectively be enrolled in the Militia by the captain or commanding officer of the company within whose bounds such citizens shall reside * * *." This law, crude and ineffective as it now appears, remained, except for minor and temporary modifications, substantially our only policy for national defense from the time of its passage up to the Great War.

Unpreparedness Sacrifices Many Lives Needlessly

DURING this period, our nation engaged in four major wars. We entered each of these wars totally unprepared and paid the penalty of unpreparedness in thousands of lives needlessly sacrificed and billions of dollars in wasted treasure. Unfortunately the memory of our people is short, and having more or less successfully survived an emergency we soon forget the cost and concentrate our interest on business, baseball or what have you.

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AND then came 1914, and a world gone mad! The slogan 'Business as usual' gave place to alarm, the platitudinous assurances of our political leaders, echoed from press and pulpit, for once failed to carry conviction, and public opinion, shaken from its inertia, began to demand in no uncertain terms that our national security be safeguarded by something besides phrases and slogans.

National Defense Act of 1916

IN response to public demand, the Congress on June 3, 1916, adopt the measure now known as the National Defense Act. This act established a basic formula for the creation of a citizen army, defined and amplified the constitutional war powers of the president, and, by the creation of the Council of National Defense, united the government and the people into a single agency, working together in the interest of our "common defense". But before the slow machinery of government could give effect to this act, we were drawn into the war—and forced to match our strength with the greatest military power the world has even known. Our experience in that war demonstrated the fundamental soundness of the National Defense Act. Wholly unprepared, we created and put in the field three thousand miles from home, the army that turned defeat into victory, while at home we transformed our people, our industries and our material resources into an invincible war machine. But how did we do it—by eighteen months of blundering, confusion and delay, at a cost of twenty billions of dollars and a hundred thousand lives.

Industrial War Planning (Act of June 4, 1920)

THAT the lessons so painfully learned during the war should not be wasted, the Act of June 3, 1916, was amended by the Act of June 4, 1920, which without modifying any of the principles so well tested by war, made an important addition to our military policy by providing legal authority for the creation and maintenance in time of peace of plans for the prompt mobilization of the entire resources of the country both human and material, for national defense and for the maintenance in skeleton form, of an organization trained to execute such plans.

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THE military and naval establishments under the National Defense Act, are charged with a twofold mission, first to preserve peace and security, and second to restore peace should it be lost or threatened. To execute this mission but two resources exist, men and material, and our first or peace time mission includes the duty of preparing the plans which will make possible the prompt and effective use of these resources, if and when needed. The effective use of our man power is dependent upon our ability to provide men with, and train them in the use of, those material things without

which they cannot fight, and in order to assure the people that these things will be provided, the Army and industry are now engaged in the joint mission of "Industrial War Planning".

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BUT what is this industrial war planning and where does it originate? Let us see what the law itself says. Section 5, a., of the National Defense Act contains these provisions:

"Hereafter, in addition to such other duties as may be assigned to him by the Secretary of War, the Assistant Secretary of War, under the direction of the Secretary of War, shall be charged with the procurement of all military supplies and other business of the War Department pertaining thereto and the assurance of adequate provision for the mobilization of material and industrial organizations essential to war time needs."

Information Required

THE task of providing this assurance falls naturally into two phases, first, those things which the military establishment must do before industry can act, and second, those things which industry alone can do. The first phase, reduced to its simplest terms is this: The Army, estimating the probable strategic mission, calculates the magnitude of the forces required for the execution of such mission, upon which basis we must, with respect to the material needs of our proposed force, furnish industry with the following information: What we need, how much we need, when, where, and in what sequence we need it. Given this information, we ask that industry inform us: from what sources will our needed material come, who will produce it and where will it be fabricated, how much can we expect, when and in what sequence can it be made available. This information, jointly prepared, tested, balanced, and made of record, provides that assurance which the people have by law demanded.

Vital Importance of Wire Industry in Industrial War Planning

IN this general picture of industrial war planning, the wire industry occupies a position of vital importance. Not only does wire, in some form enter into the fabrication of every item of military equipment from the airplane to the horse shoe nail, but without wire communications an army in battle would be a pitiful and futile thing.

A Typical Requirement--Twisted Pair Field Wire

I shall not attempt to describe the manifold purposes to which wire is applied in war material, but with your indulgence, I will try to convey some of the significant facts about one single type of wire used for a single purpose—namely, twisted pair field wire. It is regarded as an axiom, that in battle there always occurs a situation in which the issue of victory or defeat hinges on the single element of time. It follows therefore, that the commander who, correctly estimating the situation, is first able to impose his will upon his forces, will in all probability be victorious. The ability of troops to promptly transmit information to their commander, and of the commander to transmit his decisions to his troops is measured by the efficiency of the available system of communications. It is not sufficient to speak of communications in their general sense, we must limit our definition to that small portion known as signal communications—the nervous system of the Army. Of the many agencies which make up a system of signal communications, wire lines for the transmission of telephone and telegraph signals form the primary, indispensable element upon which all other agencies are dependent.

Necessity for Good Quality of Wire

WIRE lines in the combat zone must be laid and maintained under the most adverse conditions; laid for the most part on the ground, they are exposed to the weather, to damage from wheeled traffic or marching troops, and to enemy fire. Laid out in the dark, crudely and often carelessly spliced these lines must possess good conductivity; their insulation must be proof against weather or abrasion; conductors must be strong enough to stand rough handling, sufficiently inert to lie flat on any kind of ground, and last but not least, wire for this purpose must be light enough to be transported on the backs of men in emergency.

Quantity Requirements

IN terms of quantity, field wire discloses some rather impressive figures. For the initial equipment of a single Infantry Division we require 523 miles of field wire, which, based on combat experience recorded during the late war, represents but nine days supply for the division in battle, or to express it in another way, a division in combat will consume over 1500 miles of wire per month. During the late war our greatest concentration of troops at any moment was forty-two divisions; if we could visualize these troops simultaneously engaged — they would consume the staggering amount of 63,000 miles of field wire per month. An exaggerated figure you will say—but let us look at some of the figures of 1918. The troops in the Services of Supply in France built and operated 100,000 miles of permanent wire lines and installed 3000 permanent telephone and telegraph stations. In the zone of advance, our units consumed 108,-921 miles of twisted pair wire from June to November, 1918. When we recall that on July 1, 1918, there were but four American divisions in the lines and that over the entire period from that date to the Armistice our average strength in the lines was only sixteen divisions, our "exaggerated" figure becomes quite conservative.

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ONE may say—if the wire makers of America made 108,000 miles of field wire in four months in 1918—there should be nothing to worry about in the matter of future production, but let us again refer to the late war. Permit me to quote from a report of the Chief Signal Officer, to the Chairman of

(*Please turn to page 65*)

Wire Galvanizing Processes

Geoffrey K. Rylands,

Rylands Bros. Ltd., Warrington, Lancashire, England

The fifth paper of a discussion on

HOT GALVANIZING VS. ELECTRO GALVANIZING

between Mr. L. D. Whitehead of Whitehead, Hill & Co., Ltd.
and Mr. G. K. Rylands of Rylands Brothers, Ltd.

Mr. Rylands continues the discussion from the last paper. In April Mr. Whitehead's reply will appear.

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At the conclusion of this series of articles Mr. W. H. Spowers, Jr., well-known consultant on galvanizing, will review the controversy.

HOWEVER, to show that there is absolutely no deception on this point, I show in Fig. 3 a photo-micrograph of Mr. Whitehead's 10-gauge wire at a magnification of 1,000 diameters. This was polished by special methods and the polishing lines on the base metal have been left intentionally. The specimen was unetched. There are no shadow effects. The line of the base metal and the line of the underside of the coat are clearly visible with the non-metallic inclusion between them, which is seen to be quite granular.

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FIGS. 4 and 5 are true cross sections of Mr. Whitehead's 8-gauge wire polished in the ordinary manner but unetched, the photographs being taken at a magnification of 1,000 diameters. These photographs show the non-metallic inclusions between the laminæ, and Fig. 5 shows very clearly the layered condition of the coat with some distortions of the laminæ in the neighborhood of a surface defect in the wire. Finally, in Fig. 6 I show a photo-micrograph of the 8-gauge electro-galvanised wire at 200 diameters. In this case the specimen was polished and etched in 2 per cent alcoholic sulphuric acid for half a second. The whole of the structure of the coat is obliterated and the coat itself appears as a mere dark smudge. In fact it is very similar to Mr. Whitehead's photo-micrographs and as meaningless. In this case a pure cross-section has been taken, and bearing in mind that the magnification of this sample is just double that of Mr. Whitehead's photographs, it is interesting to compare the real coat thickness as shown in Fig. 6 with the apparent coat thickness shown in Mr. Whitehead's oblique samples. I do hope that these photo-micrographs will convince Mr. Whitehead and his experts of the value of high-power examination, provided proper methods of specimen preparation are adopted.

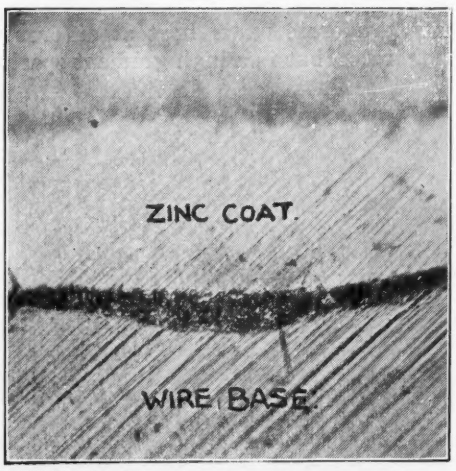

Fig. 3.—Electro-galvanised Wire. Polished only, showing Non-metallic Layer between Coat and Base. X 1000. ✦ ✦ ✦ ✦ ✦

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IN the case of these specimens the films of non-metallic impurity are no more than .002 millimetres thick. At a magnification of 100 diameters they would appear as mere lines .2 millimetre, but at 1,000 diameters they become features of some importance 2 millimetres thick. Under low-power examination, therefore, even with perfect conditions of polishing, etching and illumination, one may miss points of extreme importance. We have discovered this by bitter experience in the examination of our own products.

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I SUBMIT, therefore, that this careful examination proves definitely that Mr. Whitehead's electro-galvanised coat is not 100 per cent pure zinc, since it contains non-metallic inclusions; whether of zinc oxide or basic salts of zinc or some other impurity is not of importance at this juncture.

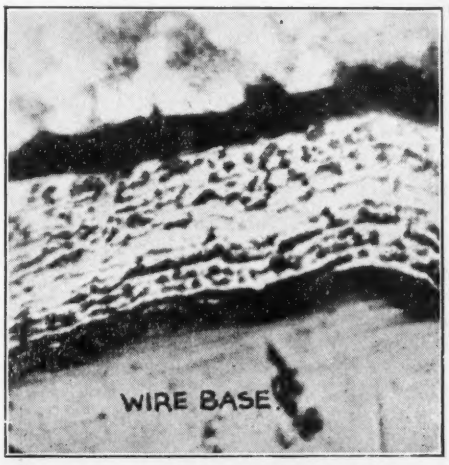

Fig. 4.—Electro-galvanised Wire. Polished only. Dark Inclusions are Non-metallic Impurities. Cross Section. X 1000. ✦ ✦ ✦ ✦

Preece and Stripping Test

MR. Whitehead seems to find the comparative results of Crapo and electro-galvanised wires under the Preece and stripping tests puzzling and contradictory. It is a well-known fact, to which Mr. Whitehead himself has referred, that copper sulphate attacks a pure coat more readily than an impure one, while with the acids sulphuric and hydrochloric the reverse is the case. For instance, I deliberately oxidised a Crapo sample and by so doing increased the dips from 5 to 10 and at the same time more than halved the time taken to strip in hydrochloric acid.

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TWO wires, therefore, having coats of identical weight and composition would give identical results in both the Preece and acid-stripping tests. If, however, the coat on one of the wires was much purer than on the other, this wire would yield a poorer Preece test and a better acid-stripping test than the other wire.

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NOW, Mr. Whitehead analyses the results of the Preece and stripping tests reported by me and by his analysis shows that, weight for weight of coat, his 12-gauge sample has a 55 per cent superiority over the 12-gauge Crapo sample under the copper sulphate test, but that under the hydrochloric-acid stripping test the Crapo sample is 61 per cent better than his wire.

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ONLY one conclusion can be drawn from this result, namely, that the electro-galvanised coat is not so pure as the Crapo coat. We do not claim 100 per cent purity for the Crapo coat, and such a claim for the electro-galvanised coat is obviously absurd. The evidence, therefore, of the microscope, the Preece and stripping tests is all against the 100 per cent zinc purity claimed by Mr. Whitehead.

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IN his article, however, he informs us that Mr. Turner found that all the usual tests were quite useless when applied to electro-galvanised wire and as a consequence Mr. Turner suggested the spectroscope as giving definite proof of the purity of the electro-galvanised coat. We must therefore examine this evidence to see whether it is as conclusive as Mr. Whitehead and Mr. Turner seem to think.

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Spectrograms

MR. WHITEHEAD is rather reticent on his spectroscopic results. He does not publish the spectrograms because, he says, they are too delicate to show up adequately. In astronomical works I have frequently examined spectrograms and have not been conscious of any abnormal difficulty in this respect. He does, however, make a somewhat apologetic reference to the presence of cadmium, lead, magnesium and calcium. So we may infer that the electro-galvanised coat does contain these impurities in small quantities. Apparently nothing which the electro-galvanised coat does contain is of any importance: it is only those impurities which he thinks it does not contain, but which are present in the hot galvanised coat, which matter to Mr. Whitehead.

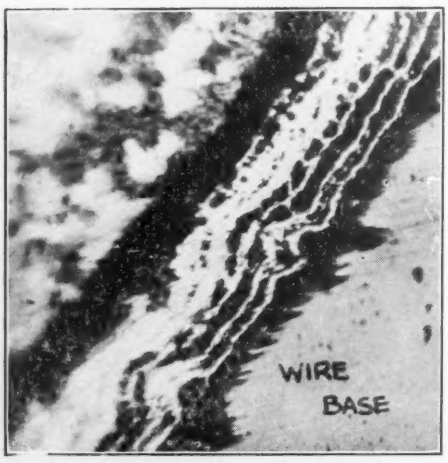

Fig. 5.—Electro-galvanised Wire. Polished only. Showing Layers of Non-metallic Impurities Present in Large Quantities. Cross Section. X 1000.

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ALTHOUGH Mr. Whitehead has not published his spectrograms, I am prepared to take his word for it that they do show the coat to be to all intents and purposes pure zinc, with small quantities of the impurities already referred to. The point is, however, whether the spectroscope proves that the zinc is there in its metallic form. Evidently from the type of instrument used the spectroscope proves nothing of the sort. Zinc present in the coat in the form of oxides or basic salts of the metal would still show on the spectrum as zinc. In fact, if Mr. Whitehead had taken a spectrogram by the method which he describes of 100 per cent zinc oxide, it would have shown 100 per cent zinc. The spectroscope therefore tends to prove that the non-metallic inclusions already observed under the microscope are in all probability zinc oxide or basic salts of the metal; it does not prove that Mr. Whitehead's coat is 100 per cent pure metallic zinc.

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Loss of Weight Test

WITH regard to the loss of weight test to which Mr. Whitehead attaches so much importance, it would seem that many features have escaped the notice of Mr. Whitehead's experts. It is known that different elements evaporate under heat at different rates, but in a high gradient spark

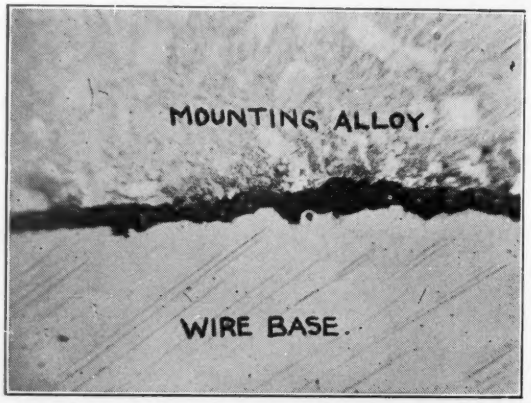

Fig. 6.—Cross-section of Electro-galvanised Wire Coat, Etched. X 200. ✦ ✦ ✦ ✦

discharge we have a mixture of evaporation and convection. Any particle liberated at a pole may go to the other pole, be deposited elsewhere, or merely fall back to the same pole depending on its electric sign. The rate of being torn off will also depend on the adhesive qualities of the particle, so that we cannot in this case apply the rule of mere heat evaporation.

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UNDER these circumstances the probabilities are that the density of the coat plays a bigger part than its purity, and it is certain that under different conditions of spark discharge quite different results would be obtained. It is possible that when properly developed and carried out under known and rigorously controlled conditions the loss of weight test may be of certain academic interest, but it is very certain that in the manner in which it has been performed and described by Mr. Whitehead's experts it is giving no information regarding the purity or otherwise of the coat.

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MR. WHITEHEAD also infers that by exposure to a condensed spark successive and uniform layers of the coat may be removed and that the spectrum will show the coat analysis of such layers. I am of the opinion that this is inaccurate, since the first action of the spark is to dig a roughly conical pit into the zinc and as a consequence, even when the coat is pierced, the outer layers will still be involved in the spectrum observed. This objection makes the spectroscopic method described by Mr. Whitehead for quantitative determination of the various impurities in successive layers useless.

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MR. TURNER, incidentally, is wrong when he states that usual chemical methods of analysis are valueless for the examination of hot galvanised coatings. If he made such a statement he can only have examined the problem very superficially. We here constantly make careful and accurate analyses of different layers of hot galvanised coats, and in view of the above objection to the spectroscopic method I am satisfied that this can be done by chemical means very much more accurately than by spectroscopic means. In fact, so far as galvanised coats are concerned, everything that the spectroscope can do at present be done as well, and in most cases better, by chemical means.

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Conclusions

I claim, then, that I have adduced conclusive evidence that Mr. Whitehead's electro - galvanized coat is not pure zinc and that it does contain non-metallic impurities. In my last article I suggested that the inclusion was probably zinc oxide and I still maintain this probability, although I admit that I have neither proved nor disproved the point. I might add, however, as an alternative, the basic salts of zinc, but, as a matter of fact, there are so many possible non-metallic inclusions which might be taken up from the electrolyte that it is hardly worth while mentioning them all, but, in passing, one might note the probability of the calcium and magnesium observed in the spectrum only being present in a non-metallic condition.

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I do not know why Mr. Whitehead should be so upset at the possibility or probability of zinc oxide in his coat. The presence of the oxide in the cathodic deposit of a metal is not very extraordinary, and the danger of such an inclusion in electro-galvanising is stressed by both Bablik, Macmillan, and other writers.

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I see that in the Iron and Coal Trades Review recently Mr. Whitehead makes three claims for his process:—

(1) The process ensures that the whole coat of galvanising is pure zinc, instead of being, as in the hot process, partially an alloy of zinc iron.

(2) Pure zinc is not only the best preventive against atmospheric corrosion, but it is extremely ductile, and, being closely adherent to the wire, does not peel, crack or flake away, when bent, crimped or twisted.

(3) The thickness of the coat is absolutely uniform.

In view of the foregoing, Claim (1) is untenable.

In regard to (2), I would draw Mr. Whitehead's attention to a letter from Professor Ulick R. Evans on "The Corrosion of Metals" in the issue of Engineering dated January 31, 1930 in which he deprecates the widely-held theory that the purer the metal the greater its resistance to corrosion. Referring specifically to zinc, he states:—

The exceptionally accurate work of Bengough, Stuart and Lee proves definitely that even spectroscopically pure zinc is corroded quite appreciably by the purest conductivity water; addition of salts to the water increases the rate of attack, which is approximately as rapid as that of zinc containing small amounts of impurities. In regard to atmospheric corrosion, Vernon's indoor tests reveal only a slight difference between the different "grades" of zinc, whilst the outdoor tests conducted by Hudson, in five different localities, indicate that there was practically no difference between electrolytic zinc and "ordinary" (impure zinc).

Patterson has investigated the various impurities one by one; in an indoor saturated atmosphere; he finds that the addition of small amounts of iron, lead, cadmium, copper or antimony to zinc has no pronounced effect on the corrosion; in indoor exposure, lead produces slight retardation of the attack, copper or antimony accelerate it, whilst cadmium and iron have no appreciable influence. In the case of immersion in acids, the effect of minor constituents is more pronounced; the measurements of Vondracek and Izak-Krizko show that whilst some constituents notably accelerate the corrosion of zinc by acids, others greatly retard it; the same conclusion was reached by Patterson.

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Ductility

AS to the question of ductility, I agree that zinc is a ductile metal in the remelted condition,

(*Please turn to page 56*)

Automatic Combustion Control Systems for Wire Furnaces

By F. Aschner and H. Mayer-Witten*

Part II -- Sec. 2

Automatic furnace control is of special significance in the manufacture of wire, since the economy of the process and the quality of the production largely depends upon the management of the furnaces and ovens.

The present articles deal with the regulating systems developed in Germany; Part I, covering the types of regulators used and Part II, showing the methods of operation and the results of service in existing installations.

ELECTRIC regulators can also be employed for gas heated stoves, as is shown by Figs. 7 and 8. Mention has already been made in the first part of this article of the metal thermostat for electric wire furnaces made by Messrs. Kieback & Peter; the connections and the exterior design are reproduced as applied for gas fired reheating furnaces. In addition to the temperature sensitive relay, the switching relay and the electromagnetically operated gas regulating valve can be recognised.

In many cases, it is preferable to use a hydraulic medium for controling the adjusting devices.

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THIS method applied to a stove, heated by gas or oil, is reproduced in Fig. 9. The contact thermostat which is sensitive to temperature change closes the circuit of a relay when the nominal temperature is attained, and thus the pressure water opening the diaphragm valve for the air and gas control, M, is liberated. The gas and air valves are simultaneously controlled by the hydraulic pressure varied in this manner.

RENDERING the entire equipment of an ingot furnace automatic, as shown in Figs. 10, and 11, at the present time may be considered unnecessary by many works managers. Naturally, this system is not applicable to every stove, particularly if the stoves operate according to older systems, but it constitutes a part of the equipment of large modern furnace units.

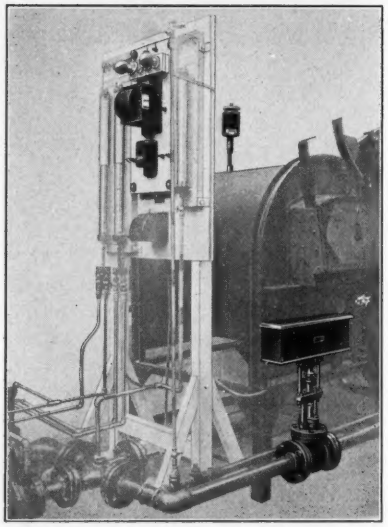


Fig. 8. View of temperature regulating plant of the Dr. Kieback & Peter's system in a gas fired annealing furnace. ✦ ✦ ✦ ✦

IN the plant shown in Fig. 10, every possible function which can be controlled by automatic regulators has been rendered automatic. The gas producer plant is controlled by a gas regulator which admits a definite volume of air to each of the five producers according to the gas pressure prevailing in front of the change-over valve; this is accomplished by way of the five load regulators h only one of

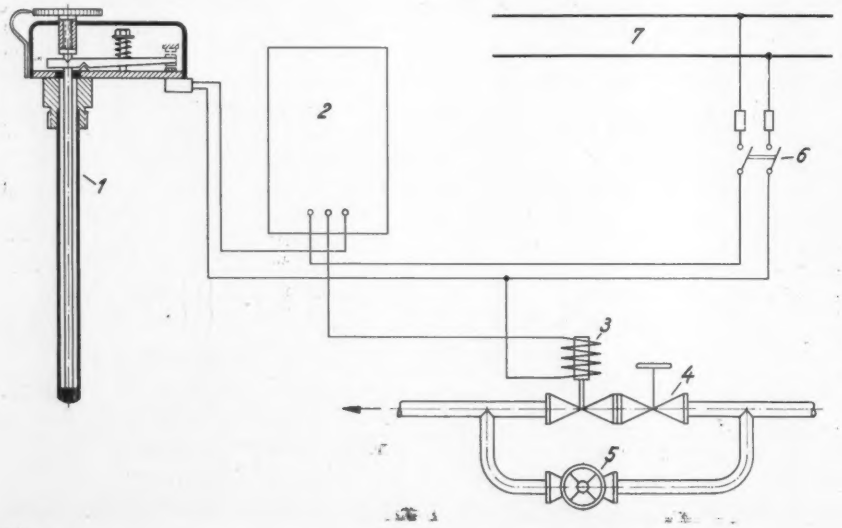


Fig. 7. Diagram of connections for a Dr. Kieback & Peter's temperature regulator with electromagnetically operated gas valve. 1. Temperature relay. 2. Switching relay. 3. Electromagnetically operated gas valve. 4. Hand valve. 5. Hand valve in the mains. 6. Switch with fuse. 7. Network. ✦ ✦ ✦ ✦ ✦

which is shown. All regulators on the stoves utilise the jet pipe principles of the AEG-Askania regulation as described in the previous article. The high temperature regulator c controls the gas volume. A mixture regulator d which can be switched over to the stand-by plant, alters the volume of combustion air supplied by a propeller type blower, hence the most favourable quantity of excess air is always present. Constant pressure in the stove is ensured by a draught regulator e which can also be changed over to either burner, this regulator controls the damper. The construction of the regulator and also the pertaining instruments are depicted in Fig. 11. A cast-iron pedestal in which the oil pump is housed, serves for mounting the mixture regulators for the admission of combustion air, the regulator for the pressure inside the stove and also the regulator for adjusting the gas volume. This last regulator is influenced by the radiation pyrometer and a current-pressure convertor suspended on the wall behind the regulator; the radiation pyrometer is not visible in the illustration.

Special care is to be directed to the receiving of impulses for high-temperature regulators. Whereas, with stoves continuously in service, the knowledge of the mean temperature of the stove leads to satisfactory results, when regulating ingot furnaces the irregular service postulates that the radiation pyrometer be set for the last ingots since these remain in the furnace for a longer or shorter period and are consequently exposed to the danger of burning even if the mean temperature remains constant. The pyrometer is consequently built in so that an inclined aperture in the front of the furnace enables the ardometer to be directed on to the front and top of the last ingot.

✦ ✦ ✦

THE working diagram for this regulation shows some interesting features. The line for the ingot temperature is approximately a straight line which shows a peak when a new ingot comes into the range of the pyrometer. A time diagram which is of use for supervising the service, is thus obtained at the same time. Identical characteristics are shown by the curves for the gas pressure and

(*Please turn to page 60*)

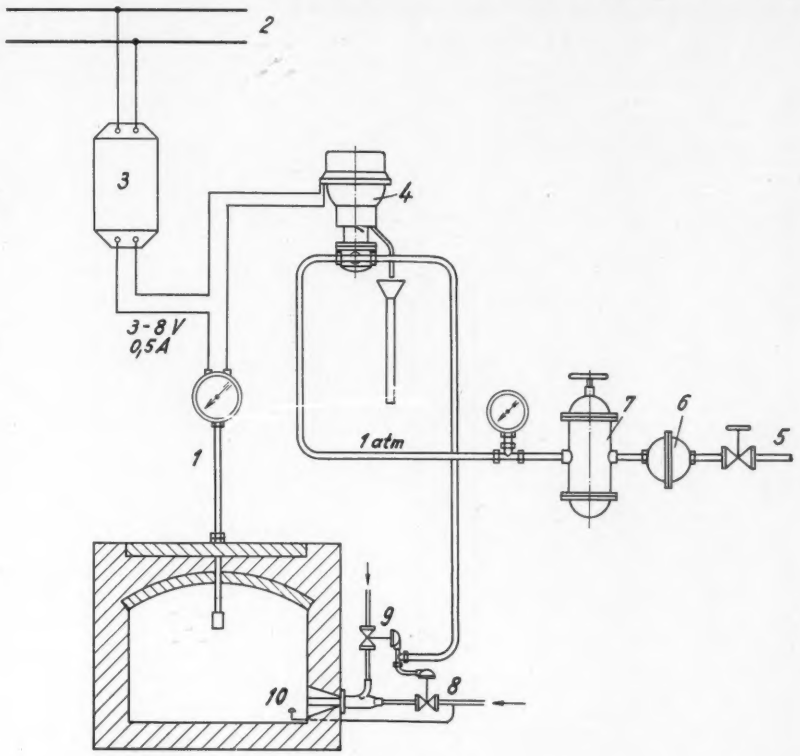


Fig. 9. Regulating plant by the Gesellschaft für selbsttätige Temperaturreglung, as fitted to the gas and air mains on an industrial furnace. 1. Contact thermometer with indicating device. 2. Network. 3. Transformer. 4. Relay for hydraulic working. 5. Pressure water main. 6. Ball filter. 7. Reduction station for water pressure to 1 atmos. gauge. 8. Diaphragm controlled by water pressure. 9. Valves for gas and air. 10. By-pass flame. ✦ ✦ ✦ ✦ ✦ ✦

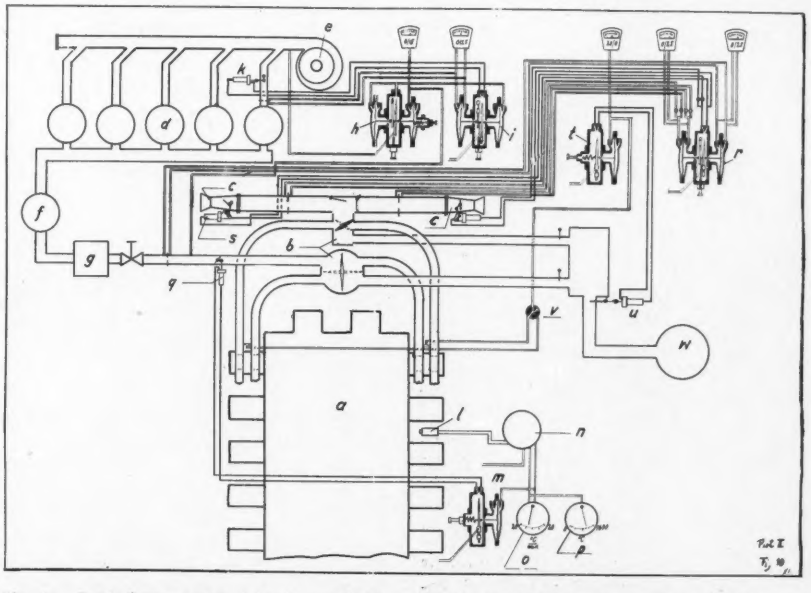


Fig. 10. Ingot furnace with Askania completely automatic regulation plant. a. Ingot furnace. b. Gas and air valves. c. Propeller type blower for air main. d. Gas producers. e. Air blower for gas producers. f. Gas scrubbers. g. Electro-filter. h. Load regulator for gas producers. k. Servo cylinder. l. Optical pyrometer. m. Temperature regulator. n. Electro-pneumatic measuring transformer. o. Temperature differential quotient meter. p. Temperature indicator. q. Servo cylinder. r. Ratio meter for gas and air. s. Servo cylinder. t. Meter for pressure inside the furnace. u. Servo cylinder. v. Change-over valve. w. Chimney. ✦ ✦ ✦ ✦ ✦

A Review of Recent Wire Patents

No. 1,834,124, SUBMARINE CABLE, Patented Dec. 1, 1931, by Ernest Fischer, of Berlin-Templehof, Germany, Assignor to Siemens - Schuckertwerke Aktiengesellschaft, Berlin-Siemensstadt, Germany, a Corporation of Germany.

This is a Pupin coil loading section for submarine cables and comprises a waterproof pressure resisting sheath, with loaded coils and individual casings for the coils, and a sponge rubber filling for the spaces between the casings and the waterproof sheath and between the walls of each casing and the loaded coil contained therein.

✦ ✦ ✦

No. 1,834,153, HAIRPIN OR SIMILAR DEVICE, Patented Dec. 1, 1931, by Philip L. Haims, of Cleveland, Ohio.

Constructed of spring wire, this hairpin has a looped position, pressure on which will release the clasping action of the legs of the hairpin.

✦ ✦ ✦

No. 1,834,159, WIRE HOLDER, Patented Dec. 1, 1931, by Thomas J. King, Jr., of Chicago, Illinois, and Ivan H. Spoor, of Berwyn, Illinois, Assignor to The Gerrard Company, Inc., of Chicago, Illinois, a Corporation of Delaware.

This holder is adapted to uncoil wire as required and is provided with a portion to direct the end of the wire so that it may be easily grasped.

✦ ✦ ✦

No. 1,834,213, DEVICE FOR SUPPORTING WIRE TYING MACHINES, Patented Dec. 1, 1931, by Thomas J. King, Jr., of Chicago, Illinois, Assignor to The Gerrard Company, Inc., of Chicago, Illinois, a Corporation of Delaware.

So as to tie a wire about a box, barrel or the like, in a horizontal plane, the inventor has provided a support for the wire tying device, which device is portable.

✦ ✦ ✦

No. 1,834,376, INSULATED WIRE, Patented Dec. 1, 1931, by Hendrik Boving, of New York, N. Y., Assignor to Western Electric Company, Incorporated, of New York, N. Y., a Corporation of New York.

This is a "flame-proof" insulated wire, having a coating of water glass (sodium silicate) and glycerine, covered in turn by a cotton or similar covering, which may in its turn be impregnated with a flame-proof material.

✦ ✦ ✦

No. 1,834,659, TROLLEY WIRE, Patented Dec. 1, 1931, by Kumatoshi Teramoto, of Kawabe-Gun, Hyogo-Ken, Japan. Assignor to Nihon Densen Seizo Kabushiki Kaisha, of Hyogo-Ken, Japan.

The assembly includes main wires of flexible, stranded metal wire, and cooperating contacting conductors sections of short length extending continuously along the length of, and in physical contact with, the main wire, with the sections arranged in end-to-end relation.

Complete Descriptions and Drawings of Patents May Be Had for 25 cents. Address, Wire & Wire Products, 551 Fifth Avenue, New York.

No. 1,834,920, SPRING BED BOTTOM, Patented Dec. 8, 1931, by George W. Barnes, of Kenosha, Wisconsin, Assignor to Simmons Company, of New York, N. Y., a Corporation of Delaware.

The combination includes, with helical coil springs, tie wires, the bodies of which pass on one side of a convolution of each spring and are formed with loops which extend thru a convolution and are bent at an acute angle around the opposite side thereof, and key wires extending transversely of the tie wires, the key wires having bent portions interlocking with and substantially enclosing parts of the wire loops, with each of the loops operatively related to a single coil spring.

✦ ✦ ✦

No. 1,834,993, WIRE UNREELING APPARATUS, Patented Dec. 8, 1931, by Duke Vance Atwood, of Anderson, Indiana, Assignor to Delco-Remy Corporation, of Anderson, Indiana, a Corporation of Delaware.

This device is provided with means to automatically take up the slack between the apparatus and the work on which the wire is being used.

✦ ✦ ✦

No. 1,835,113, PROTECTIVE COATING FOR METAL SURFACES. Patented Dec. 8, 1931, by Charles V. Iredell, of Bloomfield, New Jersey, Assignor to Westinghouse Lamp Company, a Corporation of Pennsylvania.

The coating is particularly applicable to copper lead wires to protect them from oxidation when heated to temperatures approximating 475° C., and is composed of boric anhydride.

✦ ✦ ✦

No. 1,835,114, AUTOMATIC GRID WINDING MACHINE, Patented Dec. 8, 1931, by Joseph Kirby, of Newark, New Jersey, Assignor to Westinghouse Lamp Company, a Corporation of Pennsylvania.

Particularly adapted for the manufacture of radiotron grids. this machine is provided to procure the grids free from strains and distortions, and is described as an improvement upon the machine disclosed in U. S. Letters Patent No. 1,585,904.

✦ ✦ ✦

No. 1,835,462, WIRE DRAWING APPARATUS, Patented Dec. 8, 1931, by Herbert S. Busey, of Providence, Rhode Island, Assignor to American Electrical Works, of Phillipsdale, Rhode Island, a Corporation of Rhode Island.

Objects of the invention are to reduce a die-holder for interchangeably mounting various types of dies adapted for drawing wire to different sizes, to provide means for circulating a cooling lubricant about the die and to feed it to the mouth of the die so as to set up a rotary motion, whereby the die is cleaned.

No. 1,835,589, MEANS FOR FORMING COIL SPRINGS, Patented Dec. 8, 1931, by Alexander Russell Bond, of Plainfield, New Jersey, Assignor to The Owen Automatic Spring Machinery Company, a Corporation of Ohio.

In this coiler, the spring is measured after it has been coiled and the spring cut off from the wire stock after the free end of the spring has described a helical orbit of a predetermined angular measure.

✦ ✦ ✦

No. 1,835,598, CHAIN MAKING MACHINE, Patented Dec. 8, 1931, by John L. Hogberg, of Attleboro, Massachusetts, and John A. Granskog, of Hills Grove, Rhode Island, Assignors to General Chain Company, of Providence, Rhode Island, a Corporation of Massachusetts.

The inventor provides in a chain making machine means for feeding, severing and bending a length of wire into open link loop form and positioning a portion of solder between the separated ends of the loop wire, means being provided for subsequently closing the ends of the loop onto the solder to form a link having a sufficient amount of solder retained at the joint so that when fluxed the abutting ends at the joint will be soldered together.

✦ ✦ ✦

No. 1,835,771, SUBMARINE SIGNALING CABLE, Patented Dec. 8, 1931, by John J. Gilbert, of Douglaston, New York, Assignor to Bell Telephone Laboratories, Incorporated, of New York, N. Y., a Corporation of New York.

The method comprises selecting from a number of core lengths a group having, as nearly as possible, equality of inductances selecting from a group thus formed, pairs having, as nearly as possible equality of capacity, to form twin core sections, and arranging the twin core sections thus formed in order of increasing hysteresis resistance losses as one proceeds from the terminal toward the center of the cable.

✦ ✦ ✦

No. 1,835,819, MACHINE AND METHOD OF ASSEMBLING SPRINGS, Patented Dec. 8, 1931, by George A. Stackhouse, of Oakland, California, Assignor to L. A. Young Spring & Wire Corporation, of Detroit, Michigan.

The method in this patent includes, in the assembling of helical springs having end coils terminating in tie members and having offsets in such end coils opposite such tie members, arranging the offsets of a number of the springs in alignment with each other in a number of adjacent rows, rotating and advancing individual spirally coiled spring cross members into engagement with the aligned offsets, and then wrapping the tie members of adjacent springs in adjacent rows around the offsets between coils of the cross members.

Exports and Imports of Wire

Exports of iron and steel wire products in October and November, 1931.
(In gross tons)

	November 1931	October 1931	November 1930
Wire rods	1,353	1,621	2,543
Hoops, bands and strip steel	1,275	1,891	2,125
Plain black or galvanized iron or steel wire	1,241	1,221	1,983
Barbed wire and woven wire fencing	1,051	1,134	2,473
Woven wire screen cloth	49	54	81
Wire rope	74	189	227
Insulated iron or steel wire and cable	4	35	20
Other wire and manufactures	267	273	395
Wire nails	618	934	781
Tacks	31	50	24
Other nails including staples	183	237	216
Bolts, machine screws, nuts, rivets and washers	261	328	533
Total, these 12 classifications	6,407	7,967	11,401

Imports of iron and steel wire and wire products into the United States
(In gross tons)

Concrete reinforcement and other bars	4,577	8,872	4,628
Wire rods	624	250	582
Barbed wire	2,072	513	279
Round iron and steel wire	202	140	216
Telephone and telegraph wire	1	14	3
Flat wire and strip steel	39	64	37
Wire rope and strand	177	197	198
Other wire	23	42	3
Hoops and bands	4,374	3,106	1,587
Nails, tacks and staples	369	604	711
Bolts, nuts and rivets	92	67	7
Total, these 11 classifications	12,550	13,869	8,251

EXPORTS of iron and steel products rose slightly during November while a considerable advance marked the import trade. A total of 59,556 gross tons of ferrous products were exported during the month—221 tons more than in October. The gain in the import trade—5,257 tons—brought the total received during November up to 34,658 tons.

✦ ✦ ✦

EXPORTS to Canada — 18,215 tons — were greater in November than in October by 1,693 tons, and included shipments of 4,257 tons of ingots. With 6,880 tons the United Kingdom took second place, 3,893 tons of steel bars being included in this total. The trade with Japan—6,751 tons—included 4,187 tons of scrap.

✦ ✦ ✦

IMPORTS rose sharply in November. Chief among the notable gains were those in ferromanganese, barbed wire, hoops and bands, and ingots. Three significant reductions were recorded—in the trade in structural shapes, in the receipts of merchant steel bars, and in the importations of concrete reinforcement bars. Among the outstanding month's trade in point of tonnage were hoops and bands, ferromanganese, and merchant steel bars.

✦ ✦ ✦

FOR the first time in many months, Belgium yielded first position (and second as well) as a supplier of iron and steel products to the United States. Germany, with 7,548 tons, led all other suppliers during November—its total including 1,711 tons of barbed wire and 1,470 tons of hoops and bands. British India with 7,148 tons—all pig iron—achieved second rank, to be followed by Belgium, whose 7,052 tons took third place . The Belgian total included 1,905 tons of merchant steel bars, and 1,110 tons of ingots. Canada was the month's fourth supplier, with a total of 5,111 tons, in which was included 2,141 tons of ferromanganese and 1,274 tons of pig iron.

✦ ✦ ✦

IN quantity the trade in card clothing rose (to 11,829 square feet), but the value of this trade declined sharply to only $10,959. The United Kingdom supplied 11,017 square feet ($9,768). Wire cloth and screening imports dropped to 23,217 square feet in November, 15,690 square feet coming from Germany, and 4,669 square feet from Canada.

✦ ✦ ✦

FOURDRINIER and other papermaking wire imports were also smaller—69,068 square feet; coming from Germany (32,986 square feet), France (15,080 square feet), Austria (14,705 square feet), Sweden (5,230 square feet), and Canada (1,067 square feet).

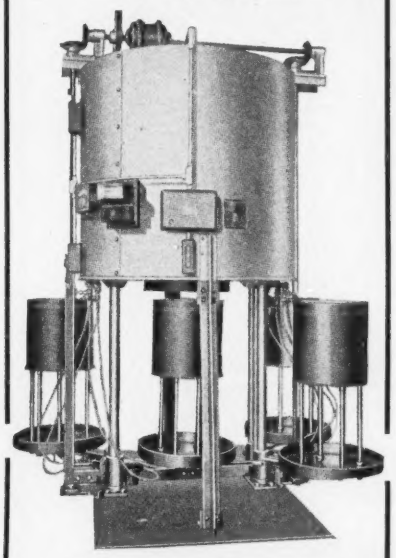
✦ ✦ ✦

IMPORTS of wire fencing and netting were greatly increased during November—that galvanized before weaving totaling 5,139,000 square feet (all from Germany) and that galvanized after weaving 1,511,350 square feet—1,315,000 square feet from Germany, 168,750 square feet from Belgium, and 27,600 square feet from the Netherlands.

✦ ✦ ✦

WIRE heddle receipts rose to 2,711,000 pieces—all coming from France. Imports of wood screws dropped to 2,823 gross, valued at $1,343—12,783 gross ($1313) coming from Sweden.

KENWORTHY
Non-Oxidizing Furnaces
For The Dry Bright Annealing of Non-Ferrous Wire.
Electric or Fuel Heated.



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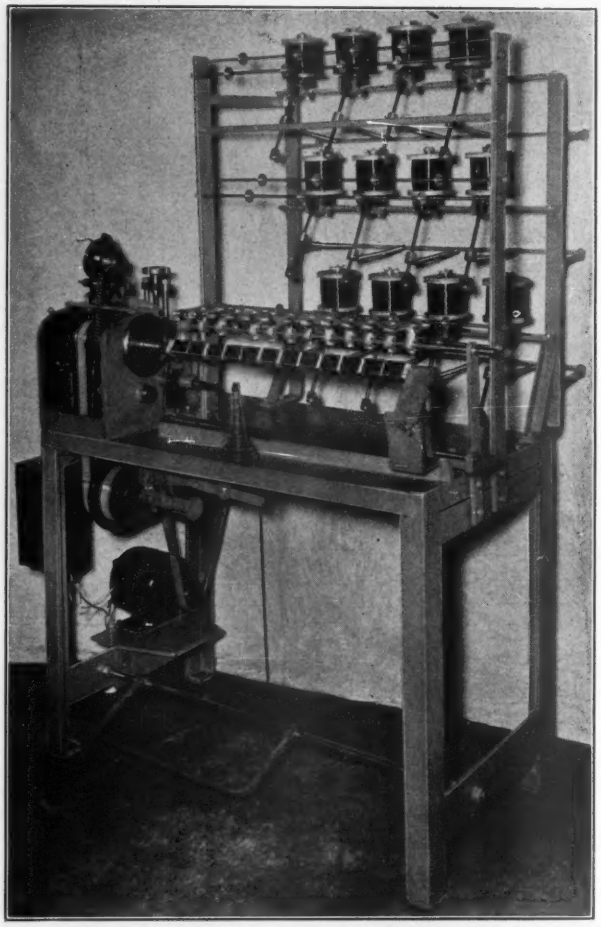

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Chain Draw Benches—Multiple Coil Winders.
Flat Wire Rolling Mills—Rod Pointers.
Hollow Wire Straighteners and Equipment.
Multiple Strand Bright Annealing Units.
Stranders to Customers' Specifications.
Reelers and Spoolers for all sizes of Wire and Cable.
Reelers and Spoolers for Tinning, Galvanizing, Patenting and Annealing.

Frederick M. Conran
Designer and Builder of Special Machinery
107 Colden St., Newark, N. J.

(*Continued from page 51*)

but Mr. Whitehead is dealing with a cathodic deposit of zinc, and such material is by no means ductile. As regards his claim that his coat is closely adherent to the wire, the photomicrographs which I have published in this and my previous article are quite sufficient proof that this claim is untenable. In addition, tests reported above show that the coating does peel and crack.

✦ ✦ ✦

The Matter of Uniformity of Coating

IN regard to (3), the table which I have published above, giving ten coat determinations at different points on each of five coils of wire, show a variation in coat percentage of from 0.78 to 3.26 per cent in one coil, and from 0.78 to 3.52 per cent over all the samples examined. With such variation the coat cannot be considered uniform. The photomicrographs, Fig. 1, also destroy any claim to coat uniformity.

Mr. Whitehead shows a sample of an electro-galvanised wire and a hot-galvanised wire linked together. It is alleged that after 3½ years' exposure, the hot-galvanised sample has become black and the electro-galvanised progressively brighter. I do not know the origin of the hot-galvanised sample; it may be Continental wiped galvanised wire. This point, however, is immaterial. We are not concerned with what happens in 3½ years. We are far more interested in the condition of the wire after 30 years, and personally I should sooner have a wire which has gone black in 3½ years than one which has become bright in 3½ years and perhaps rusty in five. Recently, I had the opportunity of examining a piece of hot-galvanised barb wire which had been erected 30 years. It was of a bluey black appearance, and only the zinc iron alloy portion of the coat remained, but it was obvious that a certain amount of secondary protection was being afforded by the products of corrosion, and

that the surface of the wire was, to all intents and purposes, passive.

Mr. Whitehead refers to the brittleness of an iron zinc alloy. To which particular zinc iron alloy does he refer? Does he mean to imply that all zinc iron alloys are always brittle under all conditions? If so, an examination of photomicrograph, Fig. 2, showing the Crapo sample after wrapping and unwrapping round its own diameter, should be sufficient to convince him that his contention is inaccurate. One might observe that steel in certain conditions is distinctly brittle, but it would be rather absurd to state that steel in all conditions was brittle.

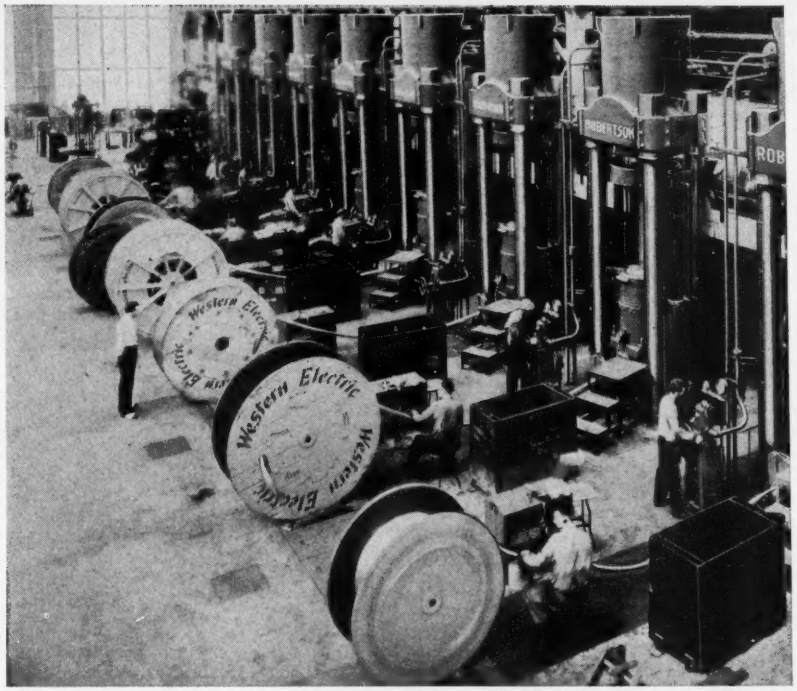
✦ ✦ ✦

Specifications

IT seems that Mr. Whitehead, supported by Mr. Turner, has expressed his dissatisfaction with all existing specifications for galvanised wire, presumably on the grounds that they do not suit the electro-galvanised product. Although I am disposed to agree with Mr. Turner and Mr. Whitehead that the present specifications are by no means perfect, I do not think that he has established a case for their alteration on the lines which he suggests, particularly as regards the application of the spectroscope. If the specification for galvanised wire requires strengthening, I am of the opinion that the introduction of a timed acid stripping test might be desirable. However, I do not suppose the wire trade as a whole, both producers and consumers, will be prepared to plunge headlong into a revolutionary revision of all specifications on recommendations made by Mr. Turner after a superficial examination of a very difficult problem.

✦ ✦ ✦

IN the March issue of Wire & Wire Products we will carry an announcement for those engaged in hot galvanizing. This article will contain the details of an entirely new flux and technique for wire galvanizing by W. H. Spowers, Jr., who is associate editor in charge of galvanizing for this publication.



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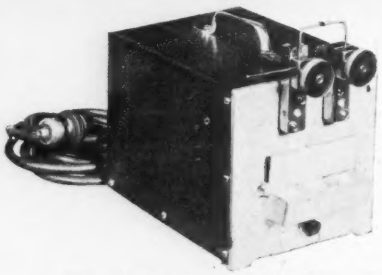

Electrical Wire Brazing and Stripping Machines

Model M-131 Portable Brazer

Photograph at right shows girl operator stripping—a slight pressure on foot pedal and a twist of the wrist and the wire is cleanly stripped.

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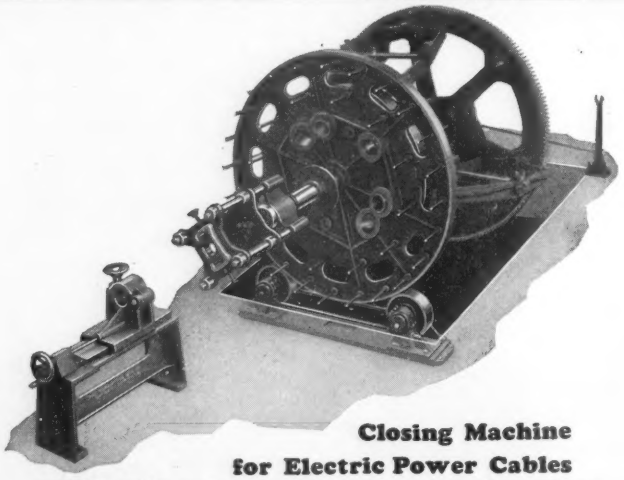

Closing Machine for Electric Power Cables

THIS machine receives two, three or four reels, as desired. Reels 48″ Dia. x 36″ over all width, held in position inclined to hollow main spindle, minimizing bending of conductors.

Planetary or rigid frame operation as desired, spindles provided for filler cops.

Twisting plate, closing die, capstan and receive reel take up are included.

Machinery for the manufacture of rod, wire and cable — Special Machinery.

The Torrington Mfg. Co.
Torrington - Conn, U.S.A.
44 Franklin St.

Nickel Silver In Rod & Wire

(*Continued from page 43*)

Rod and Wire, and is treated in the following manner.

Melting and Casting

OF course, the first step is melting and casting. The melting is done either in Electric Induction furnaces or in coal-fired pit furnaces using plumbago crucibles the latter with a working capacity of slightly over two hundred pounds of the molten alloy. The raw materials used are copper, zinc, and electrolytic nickel, each of which elements is purchased only in the highest purities possible to obtain commercially. Each shipment of these virgin metals is carefully analyzed by the Chemical Laboratory, before it is released for production. A certain percentage of clean, mill scrap of known composition, or of such scrap returned from customers, cutting-up eparition, is usually included in the charge. Utmost care is taken to avoid scrap of doubtful origin, or which might contain harmful impurities from any source. Sometimes it is necessary to incorporate a small percentage of lead with Nickel Silver in order to obtain specific properties in the finished alloy, for example: free machining quality. This is not accomplished by using a lower grade of zinc, as might be thought natural, but by the use of the correct weight of a special grade of lead in addition to the regular highest purity copper, zinc and nickel. A small percentage of manganese is added to the melt as a flux before pouring. Hardwood charcoal is used during the entire melting cycle as a protection against oxidation.

✦ ✦ ✦

Heat Treatment

THE temperature at the time of pouring ranges from 1950° F. to 2300° F., depending on the grade of alloy. Generally speaking, higher nickel content for a given copper-zinc ratio, and higher copper for a given nickel content, requires a higher pouring temperature. The metal is poured into split chill molds forming cylindrical bars.

The molds are prepared to receive the molten metal by thorough cleaning and then coated with a protective coating of oil, which serves both to prevent fusion of the metal with the inner mold surface, and to provide a reducing flame for the molten metal to fall through, thus tending to prevent oxidation. The rate of pouring has to be very steady and, of course, shrinking is essential to reduce piping at the top. The cast bars are mostly about eight feet long, the diameter varying from 1¾" to 2½", depending on the requirements of the finished metal. When the alloy has set and cooled to blackness, the bar is removed from the mold and taken to a pair of alligator shears where the gate is cropped, and the bar inspected for soundness and surface appearance.

✦ ✦ ✦

Analysis and Testing

SAMPLES of all furnace heats and from a percentage of crucible heats are taken for chemical analysis, as well as special jobs. No metal is sent from the Casting Shop to the Rod Mill until released by the Laboratory after precautionary checking for correctness of composition.

✦ ✦ ✦

Scalping

THE first operation on regular Nickel Silver rods after coming from the Casting Shop to the Rod Mill, is overhauling or scalping. This is the descriptive term applied to the removal of all surface imperfections. This removal is necessary to prevent the development of defects later in the manufacturing process, which would be objectionable in any case and would unfit the bar entirely to meet exacting requirements.

✦ ✦ ✦

Cold Rolling

AFTER the rod has been overhauled, it is rolled on a two-high mill, using chilled iron rolls, motor driven. The first pass through these rolls gives the rod an oval section, and an oval shape

(*Please turn to page 61*)

HUDSON WIRE CO.

Successors Royle & Akin

Fine Wire Manufacturers

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Manufacturers of Fine Bare Wires

Copper Wire Specially Processed for Enameling Purposes

Copper	Lead
High Brass	Zinc
Low Brass	Commercial Bronze
Pure Tin	Phosphor Bronze
Cadmium	Silver Plated Copper
Bronze, Various Grades	False Gold

10%, 18%, 30% Nickel Silver

LAHN

False Gold Copper Silver Plated Copper

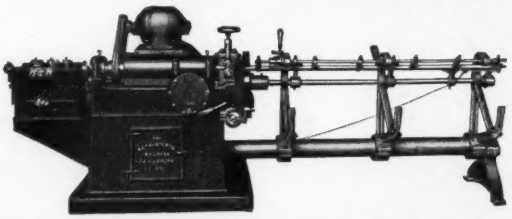
BRUSH WIRES CRIMP and STRAIGHT

Brass	Copper
Steel	Nickel Silver
	Phosphor Bronze

Metallic Fibre for Packing Purposes

Cutting Wire Faster and at Lower Cost on

SHUSTER AUTOMATIC WIRE STRAIGHTENING & CUTTING MACHINES



operating costs extremely low. Each length is an exact duplicate of the one before it and the wire is perfectly straight.

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Are you interested in straightening flat wire? We make a line of machinery for this.

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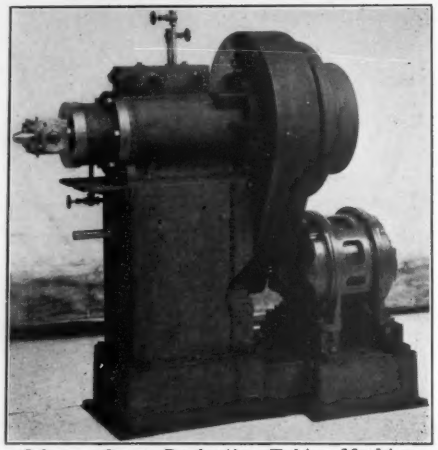
Straightener Specialists Since 1866

Johnson Super Production Tubing and Straining Machine



Johnson Super Production Tubing Machine.

Performance always reflects the true measure of merit. The Johnson Super Production Tubing Machine is demonstrating daily by performance.

It has no peer for wire covering or tubing speed.

Burning of compound is reduced, not increased.

Bulletins fully describe the inside and outside working of the Tubing and Straining Machine, and will be sent on request with all other information to cover your special requirements.

We can tell you how to make big producers of most of your present tubers, and will welcome inquiries covering possibilities in this line. Address all inquiries to

CORONE WIRE INSULATORS, INC.

Sole Distributors under the Johnson Patents

PUTNAM, CONN.

Automatic Combustion Control Systems

(*Continued from page 53*)

air volume. In these curves, additional identification shows the times at which the air and the gas were switched over (regenerative process). In spite of the frequent switching operation effected by the regulating devices, the pressure in the furnace is maintained practically constant because the closing time of the flue damper is exceptionally short as a result of the sensitivity of the regulator and the friction-free bearings on the damper.

✦ ✦ ✦

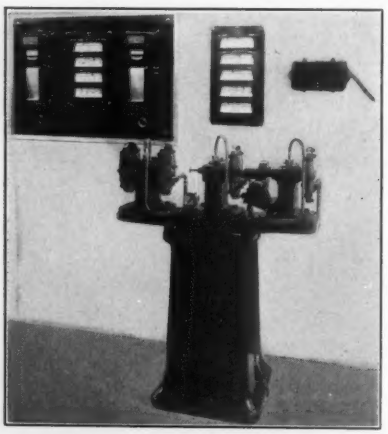


Fig. 11. Askania control and instrument installation for an ingot furnace. The pedestal supports. On right-hand: control mechanism for furnace temperature; in center: control mechanism for furnace temperature; on left-hand: control mechanism for gas and air ratio. Electrical pneumatic measuring transformer is mounted on the right-hand side of the wall. ✦ ✦

THE regulating plant just described proves the extent to which it is possible to make a plant automatic. The increasing size of stove units and the efforts towards greater economy in the service render automatic operation more and more essential because the value of the material in a single charge and the cost of fuel are such that the dependence on the momentary attention of the staff must be excluded. In addition to the preceding fact, with large

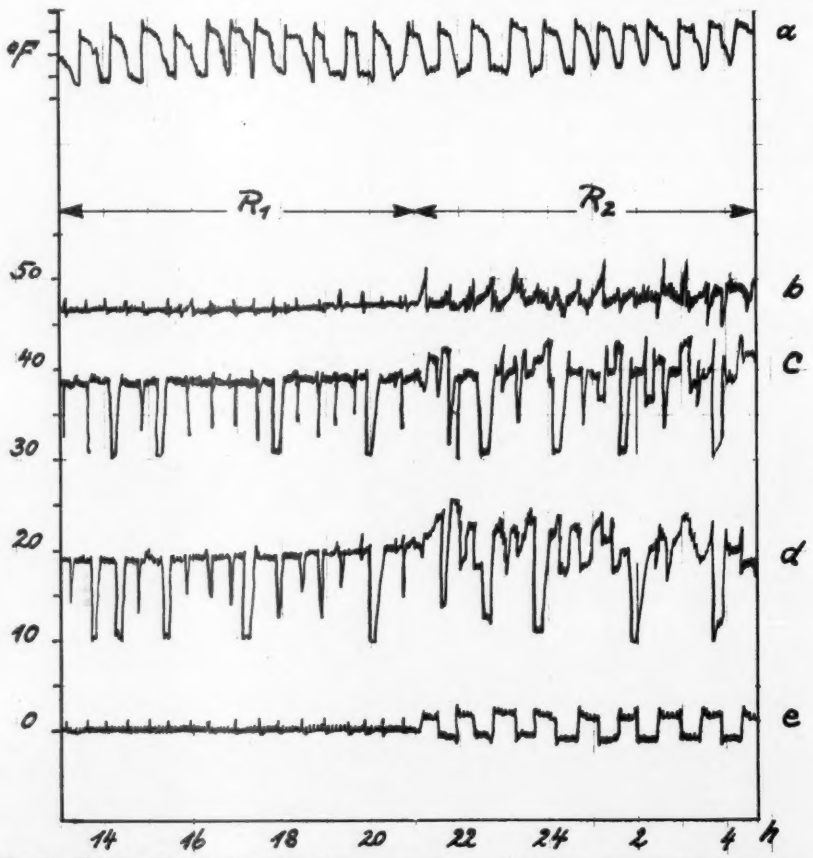


Fig. 12. Working diagram of an ingot furnace as in Fig. 10. (reproduced from original chart). R_1 Operation with regulator. R_2 Operation without regulator. A. Ingot temperature; b. Gas pressure; c. Gas volume; d. Air volume; e. Furnace pressure. ✦ ✦ ✦ ✦ ✦

stoves, the adjusting devices and the operating force required becomes desirous from the point of view of reducing the physical demands on the attendants.

Enhancing the quality of the product is a further and almost the most important, reason for the introduction of automatic regulators.

✦ ✦ ✦

Nickel Silver In Rod and Wire

(*Continued from page 59*)

is retained until the final pass before drawing. The long axis of the oval section changes about ninety degrees at every pass. A cut of the rod rolls is shown in Fig. 1.

✦ ✦ ✦

Annealing

AFTER two or three passes through the rolls, the metal has become hardened by the cold work to such an extent that annealing is advisable. This operation is a very important one, particularly because Nickel Silver does not soften so readily or rapidly when heated, as do most nonferrous alloys, such as brass, bronze, etc. A long time soaking anneal is the most practical to give the best results. The rolled rods are loaded onto sheet iron pans and pulled into an annealing furnace, which is kept at the correct temperature by the aid of a carefully planned pyrometer installation. The annealing period depends on the weight of alloy in the charge, as well as the composition. When this has been kept at the proper temperature for the required length of time, the pan is pulled from the furnace and allowed to cool slowly. Nickel Silver in rod or wire form, is quite sensitive to sudden temperature changes and the best practice is to heat slowly to temperature, soak well, and cool slowly.

✦ ✦ ✦

Cleaning

THE rolling and annealing cycle described above, is repeated several times until the rod is down to ¾" diameter, when it is round-

Bell Mine Products

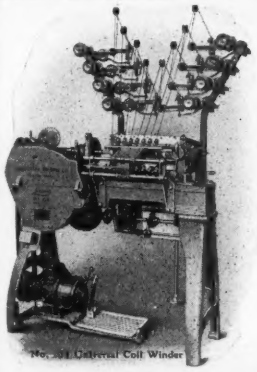
Bell Mine Rotary Kiln

Pulverized Lime is especially well suited for use in Wire Drawing • It is mined from the famous Bellefonte vein of high calcium stone and burned in rotary kilns • It is free from grit and impurities.

BELLEFONTE PITTSBURGH

AMERICAN LIME & STONE CO.

PHILADELPHIA NEW YORK CITY



No. 31 Universal Coil Winder

An interesting development for more efficiently producing paper-insulated coils. Paper is injected automatically without attention from the operator. Fully adjustable for a wide range of coil and wire sizes.

Six other machine types complete a line of coil winders answering any possible manufacturing need.

Catalog is available on request.

UNIVERSAL WINDING COMPANY
BOSTON

LEESONA

WIRE DRAWING Machinery and Equipment

Rod Frames—16" Frames
8" Frames—Take-Up Frames
Wire Pointers—Puller Tongs
General Castings for Wire Mill Use
Circulars on Request.

E. J. SCUDDER FOUNDRY & MACHINE CO. TRENTON N. J.

INSULATING MACHINES

SINGLE AND DOUBLE COVERING FOR COTTON OR SILK
HIGH SPEED BALL-BEARING SPINDLES

NEW ENGLAND BUTT COMPANY

Office and Factory
304 Pearl St., Providence R. I.

Western Office
20 North Wacker Drive, Chicago, Ill.

We build a complete line of Stranding Machines, Cabling Machines, Closing Machines, Rubber Strip Covering Machines, Measuring Machines and Other Allied Machines for the Wire Trade.

OUR WIRE MACHINERY CATALOGUE SENT ON REQUEST

RUESCH

SPECIAL MACHINERY DESIGNED AND BUILT FOR WIRE, TUBE AND BRASS MILLS

H. J. RUESCH MACHINE CO.
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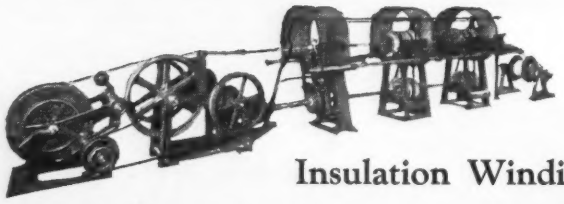


HIGH SPEED BALL-BEARING

Insulation Winding Machine

for applying two tapes from concentric rolls and a cotton binder. Machine has automatic stops for broken tapes or exhausted rolls of tape. Can be built for any number of tapes.

EST 1855 AIMCo INC 1915
"American" INSULATING MACHINERY COMPANY
REG. U.S. PAT. OFF.
517 Huntingdon St.
PHILADELPHIA PENNSYLVANIA U.S.A.

WIRE BUNCHING MACHINES
WIRE STRANDING MACHINES
TWINNING MACHINES Up to And Including SEVEN CONDUCTORS

(Manufactured under the Dawes Patents)

HASKELL-DAWES MACHINE CO., INC.

Ontario St. Below Trenton Ave.,
Philadelphia, Pa.

ed and coiled. After the anneal following the coiling operation, the coil is cleaned from heavy oxide by pickling, rinsing and dipping in soap lubricant. The end is then pointed in the usual manner by swaging dies and the coil delivered to the bull blocks. Here it is drawn through a steel die and then returned for annealing. The annealing, pickling, etc. cycle is repeated several times until the coil has a diameter of $\frac{3}{8}$", which is stock size for the Wire Mill.

✦ ✦ ✦

THE cleaning cycle, after the anneal at $\frac{3}{8}$" diameter, differs somewhat from that on the larger sizes. This must be done before the wire goes to the bench blocks, so a special pickle is used, which effectively removes the last bits of oxide. Rinsing is done more carefully here and soaping is omitted, but a thorough treatment in a threshing barrel is given before the wire goes to the Wire Mill.

✦ ✦ ✦

Wire Mill

HERE the wire is reduced in the normal way through chilled iron and special composition steel dies on bench blocks, of which Fig. 2 gives an idea. At the predetermined gauge, it goes to the Fine Wire Mill, where it is drawn to its finished size through diamond dies.

✦ ✦ ✦

THERE is one special form of wire which is quite popular in the advantages it offers for some purposes over slit sheet metal, as turned out by the Sheet Mill. This is round edge flat wire.

✦ ✦ ✦

Round Edge Flat Wire

ROUND edge flat wire is made by taking round wire at the required size and rolling it flat on two-high rolls having a short length and very rugged bearings for their diameter. Such wire can be held to close tolerance both for width and thickness, has round edges and is straight in contrast to the sharp edge and slight bow, which necessarily results from the usual slitting of sheet metal. It also avoids the variation in gauge of slit stock resulting from the

natural difference in thickness from edge to center of the sheet before slitting, and has the added advantage that commercial coils run as heavy as one hundred pounds, even in very narrow widths.

✦ ✦ ✦

Uses of Nickel Silver Rod and Wire

IN the above we have endeavored to present an outline by which Nickel Silver is manufactured in the form of rod and wire. In this form it is used for a multitude of purposes where one or more of its peculiar characteristics make it valuable. Among these might be mentioned automatic screw machine products of all descriptions, bolts, nuts, rivets and pins, springs, cutlery points, fasteners, electrical appliances, optical goods, trusses and wire cloth.

✦ ✦ ✦

THE appointment of the **Diamond Die Company of America**, 254 W. 31st Street, New York City, is announced as licencees for Ramet Wire Dies.

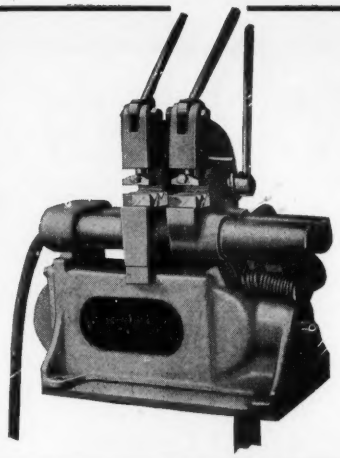
These Dies are made of Tantalum Carbide, a wear-resisting alloy providing many advantages and economies. Contains no iron or steel, yet it is one of the hardest metals known to science.

Though this material is extremely hard, it has great strength and toughness, which makes it unsurpassed as a wear-resisting material. It is fine grained, and, in contrast to other hard metals, is entirely free from porosity. It, therefore, takes an extremely high polish.

Tantalum is converted into Tantalum Carbide, mixed with alloying ingredients, ground into powder, pressed into die nibs, and heat treated in an electric furnace.

The coefficient friction is low, due to the high polish which can be obtained and the inherent characteristics of the metal. Where resistance to abrasive wear is important this material is claimed to be superior.

These Dies are offered with openings from .010° to .500″ in seven standard nib sizes. All finished dies are mounted in casings of ample dimensions and great strength.



Wire and Rod Welding

Better—Faster—at Less Cost

Spot Welders—Butt Welders

Write for full details of this NEW kind of butt-welding and spot-welding machine. It is more compact; more efficient and lower-priced than others—a statement we will gladly prove.

MICRO PRODUCTS CO.

140 Industrial St. Peoria, Ill.

European Office, H. A. Schlatter & Co.

Zurich, 1, Limmatquai 32, Switzerland.

ROCKWELL

FURNACES

ELECTRIC *and* FUEL

For Ferrous and Non-Ferrous Wire Products

Complete heating equipment for strand annealing, billet heating and intermediate operations.

Bright annealing furnaces for ferrous and non-ferrous metals.

"Furnace and Fuel to Suit Conditions"

ELECTRICITY—GAS—OIL—COAL

W. S. ROCKWELL COMPANY

Industrial Heating Equipment

1885-1 50 Church Street (Hudson Terminal Building) New York

offers you bright annealing for non-ferrous metals

Bright annealing of non-ferrous metals, a process long thought impossible, comes after long research from Surface Combustion laboratories. The photo above was taken in these laboratories—it shows the latest development in this process. It also shows the lengths to which these engineers go in development . . . the pains they take . . . the expense . . . before a furnace is released to its market. If you want to know more about bright annealing, please write.

OPERATED BY HENRY L. DOHERTY & COMPANY

Surface Combustion

TOLEDO, OHIO • SALES AND ENGINEERING SERVICE IN PRINCIPAL CITIES

DIAMOND DIES

When purchasing
Diamond Dies
avail yourself of the
forty years' experience
of the famous

P-H-I-L-I-P-S W-O-R-K-S

Any inquiries will be dealt with promptly

RAW MATERIAL DEPARTMENT

PHILIPS LAMP WORKS

EINDHOVEN HOLLAND

Wire
Drawing
Diamond
Dies

COCHAUD
WIRE DIE CORPORATION
300 W. 56th ST., NEW YORK
Tel. Col. 5-1340

A merger between the **New York Insulated Wire Company** in operation in Wallingford for years and the **Essex Wire Corporation** of Detroit, Mich., has been formally announced. The deal was completed January 7th. The Wallingford plant will continue to operate undr its present name, but as a branch of the Detroit company.

The Essex Wire Corporation was at one time a division of the Ford Motor Company, but recently was taken over by private interests. It manufactures wire and other insulated articles used in automobiles.

✦ ✦ ✦

T. P. Draper, formerly in an executive position with the Sharon Steel Hoop Company, has been appointed general manager of the Steubenville works of The Wheeling Steel Corp. He succeeds F. C. Swartz, resigned. The change in management is effective as of January first, Mr. Draper to be in active charge of all production and management at Steubenville some time this month.

BRAND
"B"
Wire Drawing Soap Powder
Made from high titre Palm Oil stock for high carbon drawing.
Proven by test to lower costs and improve efficiency.
Manufactured exclusively for wire drawing by

THE J. T. ROBERTSON CO., INC.
SYRACUSE, N. Y.
Wire drawing soap specialists since 1893.

VIANNEY
DIAMOND
DIES

100 FIFTH AVE · NEW YORK

The Waterbury Wire Die Co.

Diamond, Composition
and
CHILLED IRON DIES
Waterbury, Conn.

Lock Washer Tentative Standard

The proposed American Tentative Standard for Lock Washers has been released by the subcommittee which developed it, to industry for general criticism and comment. This proposed standard was developed by a subcommittee of the Sectional Committee on the Standardization of Plain and Lock Washers organized in 1926 under the procedure of the American Standards Association and sponsored by The American Society of Mechanical Engineers and the Society of Automotive Engineers.

In addition to introductory notes there is a table of dimensions for lock washers (spring washers) giving the nominal size, actual inside diameter, dimensions for washers for use with wrench head bolts and nuts, and slotted head screws.

Those desiring an opportunity of examining a copy of this proposed American Tentative Standard for Lock Washers with a view of transmitting comments to the Committee may obtain a copy by addressing their request to Mr. C. B. LePage, Assistant Secretary, ASME, 29 West 39th Street, New York, N. Y.

✦ ✦ ✦

Industrial War Planning

(*Continued from page 48*)

the War Industries Board, on October 25, 1918,—

"The best production which has been reached thus far in any single month is 8000 miles, and this figure must be increased without delay to 65,000 miles."

The Armistice found the American Expeditionary forces with less than five days supply of field wire between them and a suspension of operations—a problem, which fortunately did not have to be solved.

✦ ✦ ✦

THIS problem, which is but one of many, is still to be solved—not today, perhaps not for many years, but it remains, and must remain until, by our joint efforts we find the answer.

The crack trains, which pay best, are trusted solely to men, who have learned from—*Experience.*

—As wire drawers for over 30 years, we know from *Experience* the particular shape of die for each material. We have found from this same experience that our special casting method of setting is best.

Why not let us quote on your diamond die requirements?

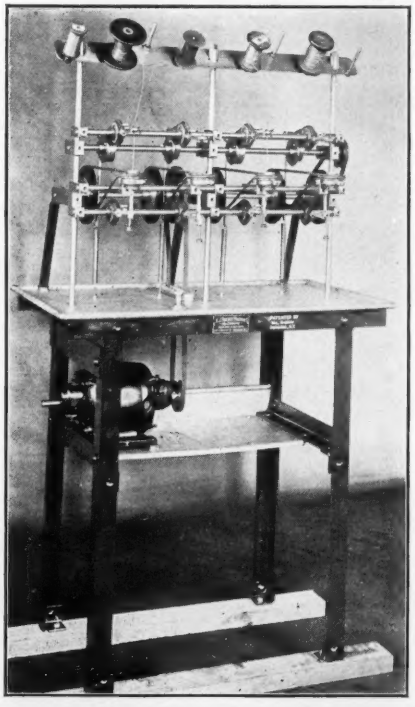
DRIVER-HARRIS COMPANY
HARRISON, N.J.
Chicago – Detroit – Cleveland – Morristown, N.J. – England – France – Italy

BALLOFFET
The Quality Diamond Dies

1870 1932

BALLOFFET DIAMOND WIRE DIES CO. INC.,
13-15 East 22nd Street, New York City
Factories in France: Lagnieu-Cluses-Trevoux

The Haddow Die Re-Cutting and Polishing Machine will lower your die re-cutting cost to a fraction of present costs



Why do you continue to pay a die cutter and pay for diamond dust to remove a large percentage of your diamond from your dies? Diamond that has done no work—when, by the use of the Haddow Die Recutting Machine you may use practically all your diamonds to draw wire, especially in the small sizes.

ONE MONTH'S SHOP PRODUCTION

Total number of dies cut —1047

Total number of hours required—182.5

Average number of dies per hour—5.73

Number of operators—1

With only one man—This machine will do the work now requiring four to six men in less time and at lower cost.

4 HEAD MACHINE—Also Made in 6-Head size (With 2 Heads for Heavier Dies).

WILLIAM HADDOW
17 Eastern Ave.
Ossining, N. Y.

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For more complete information, consult the annual Directory, Index & Buyers' Guide.

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See Furnaces—Various Headings

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Scudder, E. J., Fdry & Machine Co., Trenton, N. J.

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Amer. Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
John Robertson Co., Brooklyn, N. Y.
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Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

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Mossberg Pressed Steel Co., Attleboro, Mass.

BRAIDER CARRIERS
Mossberg Pressed Steel Co., Attleboro, Mass.

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E. J. Scudder Foundry & Machine Co., Trenton, N. J.

CLEANING & PICKLING EQUIPMENT
Vaughn Machinery Co., Cuyahoga Falls, O.

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H. J. Ruesch Machine Co., Newark, N. J.

COMPOUNDS—Insulating
Corone Wire Insulators, Inc., Putnam, Conn.

COMPOUNDS—Wire Drawing
Oak Chemical Co. Bechtelsville, Pa.

COPHOLDERS
Mossberg Pressed Steel Corp., Attleboro, Mass.

CRANES—Wire Mill
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

DIES—Chilled Iron
Waterbury Wire Die Co., Waterbury, Ct.

DIES—Composition
Vianney Wire Die Works, New York, N. Y.

DIES—Diamond
Balloffet Diamond Wire Dies Co., Inc., N. Y. C.
Cochaud Wire Die Co., New York.
Driver-Harris Co., Harrison, N. J.
Master Wire Die Corp., New York, N. Y.
Union Wire Die Corp., New York, N. Y.
Vianney Wire Die Works, New York.
Waterbury Wire Die Co., Waterbury, Ct.

DIES—Lead Extrusion
John Robertson Co., Brooklyn, N. Y.

DIES—Repairs & Re-Cutting
Balloffet Diamond Wire Dies Co., Inc., N. Y. C.
Cochaud Wire Die Corp., New York.
Driver-Harris Co., Harrison, N. J.
William Haddow, Ossining, N. Y.
Vianney Wire Die Wks., N. Y.

DIES—Recutting and Repolishing Machine
Wm. Haddow, Ossining, N. Y.
Vianney Wire Die Works, New York, N. Y.

DIES—Rod and Tube Drawing
Carboloy Co., Inc., Newark, N. J.
Master Wire Die Corp., N. Y.
Union Wire Die Corp., N. Y.
Vianney Wire Die Works, New York, N. Y.

DIES—Tantalum Carbide
Vianney Wire Die Works, New York, N. Y.

DIES—Tungsten Carbide
Carboloy Co., Inc., Newark, N. J.
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Surface Combustion Co., Toledo, O.

FURNACES—Automatic
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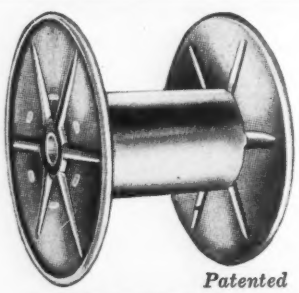

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MOSSBERG
Reels and Spools
Made of Pressed Steel

A complete line of reels and spools for every phase of manufacturing, handling and shipping. They are practically indestructible. Send for catalog of stock designs or for quotation on your own specifications.

Above: a curled flange, pressed steel spool for handling and shipping. Pressed-in radial ribs give added strength. Barrels are provided with our patented rib filler.

MOSSBERG
Pressed Steel Corp.
Attleboro, Mass., U. S. A.
Makers of "Mosspeed" Braider Carriers.

LEADERS

of the Wire and Wire Products industry like the Victoria.

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There is a reason.

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This new luxuriously appointed hotel meets every requirement, when visiting New York. Each one of its thousand rooms contains the most modern innovations, such as RADIO, tub and shower, circulating ice water and servidor. The amusement, shopping and theatre centers are all close by.

SINGLE from $2.50 daily DOUBLE from $4.00 daily

Hotel Victoria

7th Ave. at 51st St., NEW YORK

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Midwestern Tool Co., Chicago, Ill.

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Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
The Waterbury Farrel Foundry & Machine Co., Waterbury, Conn.

LIME—Pulverized
Amer. Lime & Stone Co., Bellefonte, Pa.

LUBRICANTS—Wire Drawing
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Oak Chemical Co., Bechtelsville, Pa.
J. T. Robertson Co., Syracuse, N. Y.

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Watson Machine Co., Paterson, N. J.

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Hope Narrow Fabric Co., Providence, R. I.
Mossberg Pressed Steel Corp., Attleboro, Mass.
New England Butt. Co., Providence, R. I.

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Midwestern Tool Co., Chicago, Ill.

MACHINERY—Bunching
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Haskell-Dawes Machine Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

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Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Watson Machine Co., Paterson, N. J.

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New England Butt Co., Providence, R. I.
Torrington Mfg. Co., Torrington, Conn.
Watson Machine Company, Paterson, N. J.

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Sleeper & Hartley, Inc., Worcester, Mass.
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Watson Machine Co., Paterson, N. J.

MACHINERY—Flat Wire
Fred'k M. Conran, Newark, N. J.
H. J. Ruesch Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Forming
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Galvanizing Wire
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Gang Winders
H. J. Ruesch Machine Co., Newark, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Insulating
American Insulating Machinery Co., Phila.
Corone Wire Insulators, Inc., Putnam, Conn.
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Lead Encasing Presses, etc.
John Robertson Co., Brooklyn, N. Y.

MACHINERY—Lead Stripping
John Robertson Co., Brooklyn, N. Y.
Watson Machine Co., Paterson, N. J.

MACHINERY—Lock Washer
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Magnet Wire
American Insulating Mach'y Co., Phila., Pa.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Measuring Wire & Cable
Hope Narrow Fabric Co., Providence, R. I.
New England Butt. Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Nail
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Panning
American Insulating Machinery Co., Phila.

MACHINERY—Pointing
Fred'k M. Conran, Newark. N. J.
Morgan Construction Co., Worcester, Mass.
H. J. Ruesch Machine Co., Newark, N. J.
E. J. Scudder Foundry & Machine Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
The Waterbury Farrell Foundry & Machine Co., Waterbury, Conn.

MACHINERY—Rivet
Waterbury-Farrell Fdry & Machine Co.,

MACHINERY—Rod
Fred'k M. Conran, Newark, N. J.
Morgan Const. Co., Worcester, Mass.
H. J. Ruesch Machine Co., Newark, N. J.
Schloemann Engineering Co., Pittsburgh, Pa.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrell Fdry & Machine Co., Waterbury, Conn.

MACHINERY—Rubber Strip Covering
American Ins. Mach'y Co., Phila., Pa.
Corone Wire Insulators, Inc., Putnam, Conn.
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Rubber Tubing and Straining
Corone Wire Insulators, Inc., Putman, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Screw Wire
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Special
Fred'k M. Conran, Newark, N. J.
H. J. Ruesch Machine Co., Newark, N. J.
E. J. Scudder Foundry and Machine Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Spooling
Fred'k M. Conran, Newark, N. J.
American Insulating Machinery Co., Phila.
Hope Narrow Fabric Co., Providence, R. I.
Torrington Mfg. Co., Torrington, Conn.
Waterbury Farrel Foundry & Machine Co., Waterbury, Conn.
Watson Machine Co., Paterson, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Spring Making
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Staple
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Straightening
H. J. Ruesch Machine Co., Newark, N. J.
F. B. Shuster, New Haven, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Straightening Hollow Wire
Fred'k M. Conran, Newark, N. J.

MACHINERY—Stranding
American Insulating Mach'y Co., Phila Pa.
Fred'k M. Conran, Newark, N. J.
Haskell-Dawes Machine Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Watson Machine Co., Paterson, N. J.

Patents—Trade Marks

All cases submitted given personal attention by members of the firm. Information and booklet free.

Lancaster, Allwine & Rommel

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Practical Engineering Advice
Vanderbilt 7395

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CLEVELAND, OHIO

BUYERS' GUIDE, Continued

MACHINERY—Strip Steel
Broden Const. Co., Cleveland, O.
Fred'k M. Conran, Newark, N. J.
H. J. Ruesch Machine Co., Newark, N. J.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Stripping Electric Wire
Midwestern Tool Co., Chicago, Ill.

MACHINERY—Swaging
H. J. Ruesch Machine Co., Newark, N. J.
Sleeper & Hartley, Worcester, Mass.
Waterbury-Farrell Foundry & Machine Co., Waterbury, Conn.

MACHINERY—Taping
Amer. Insulating Mach. Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Torrington Mfg. Co., Torrington, Conn.
Watson Machine Company, Paterson, N. J.

MACHINERY—Trolley Wire
Torrington Mfg. Co., Torrington, Conn.
Waterbury Farrel Foundry & Machine Co., Waterbury, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Tube Mill
Fred'k M. Conran, Newark, N. J.
H. J. Ruesch Machine Co., Newark, N. J.
Schloemann Engineering Company, Pittsburgh, Pa.
Torrington Mfg. Co., Torrington, Conn.
Waterbury-Farrell Fdry. & Machine Co., Waterbury, Conn.

MACHINERY—Welding Wire
Micro Products Co., Peoria, Ill.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Winding
American Insulating Mach'y Co., Phila., Pa.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Universal Winding Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wire Drawing
American Insulating Machinery Co., Phila.
Broden Const. Co., Cleveland, Ohio.
Fred'k M. Conran, Newark, N. J.
Morgan Construction Co., Worcester, Mass.
H. J. Ruesch Machine Co., Newark, N. J.
E. J. Scudder Foundry & Machine Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Manufacturing Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury Farrell Foundry & Machine Co., Waterbury, Conn.

MACHINERY—Wire Rope
New England Butt Co., Providence, R. I.
Watson Machine Company, Paterson, N. J.

PACKING—Metallic Fibre
Hudson Wire Co., Ossining, N. Y.

POINTERS—Wire
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

POTS—Lead Melting
John Robertson Co., Brooklyn, N. Y.

PRESSES—Lead Encasing
John Robertson Co., Brooklyn, N. Y.

PRESSES—Lead Extrusion
John Robertson Co., Brooklyn, N. Y.
Schloemann Engineering Company, Pittsburgh, Pa.

PULLERS—Wire
E. J. Scudder Fdry. & Machine Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.

PUMPS—Hydraulic
John Robertson Co., Brooklyn, N. Y.

REELS AND SPOOLS—All Kinds
R. B. Hayward Co., Chicago, Ill.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.

REEL AND TENSION STAND—
Sleeper & Hartley Inc., Worcester, Mass.

REEL CRUTCHES
R. B. Hayward Co., Chicago, Ill.
Watson Machine Co., Paterson, N. J.

ROLLING MILLS
Fred'k M. Conran, Newark, N. J.
Morgan Construction Co., Worcester, Mass.
H. J. Ruesch Machine Co., Newark, N. J.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrell Foundry & Machine Co., Waterbury, Conn.

SOAPS—Wire Drawing
R. H. Miller Co., Homer, N. Y.
J. T. Robertson Co., Syracuse, N. Y.

SOLDER—Silver
Handy & Harman, N. Y.

SPOOLS—Annealing—Detachable Head Handling—Wire Stitching
Mossberg Pressed Steel Corp., Attleboro, Mass.

TANKS—Compound
Watson Machine Co., Paterson, N. J.

TRUCKS
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

TUBE BENDERS AND FORMERS
H. J. Ruesch Machine Co., Newark, N. J.

VULCANIZERS
Watson Machine Co., Paterson, N. J.

VULCANIZING PANS
American Insulating Mach'y Co., Phila., Pa.
Mossberg Pressed Steel Corp., Attleboro, Mass.

WIRE—Various Kinds
Hudson Wire Co., Ossining, N. Y.
Jones & Laughlin Steel Corp., Pittsburgh
Seymour Mfg. Co., Seymour, Conn.

This is a carefully classified index of concerns who specialize in this industry and who advertise regularly in WIRE & WIRE PRODUCTS. Please mention WIRE when writing to these firms.

WATERBURY-FARREL

TANDEMS

No. 2 5-die machine, block type with stripper and optional floor spooler. Wire finished in coils or spooled, as preferred. Starting size 3/8 in. copper rod, finishing at No. 5 or No. 6 B. & S. gauge. Flexible - coupled enclosed herringbone drive. Antifriction bearings throughout. Aluminum swing cover for dies.

THE CULMINATION OF MORE THAN 25 YEARS AS BUILDERS OF CONTINUOUS WIRE DRAWING MACHINES OF MERIT

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A machine that meets the present day demand for high speed and maximum production efficiency. The No. 2 machine is built in both 5 and 6-die constructions. The No. 1 tandem machine is built in from 5 to 10-die construction. May we send you our complete catalogue of wire drawing machinery?

THE WATSON MACHINE COMPANY

ESTABLISHED 1845

PATERSON, NEW JERSEY, U. S. A.

DRY and WET TYPE CHALKERS

FILLING PORT
EXIT END FOUR WAY ROLLER GUIDE
ADJUSTMENT FOR CAPSTAN WRAPS WITH DRIVE AUTOMATICALLY ALLOWING CHANGE IN POSITION
WATSON
WELDED FRAME TO SUIT APPLICATION
DRY CHALKER
(FOR DIAMETERS UP TO 5")
THE WATSON MACHINE COMPANY
PATERSON - NEW JERSEY
W633

Dry Chalker shown equipped with four-way Roller Guide and side adjustment for position after Capstan. Also built for installation ahead of Capstan, eliminating these features.

The roller barrel has end zone chalk catchers and entrance and exit end cable seals. Fins inside of barrel lift chalk, and brushes wipe it around cable.

Drive arranged to give definite number of revolutions per unit length of cable passing Capstan.

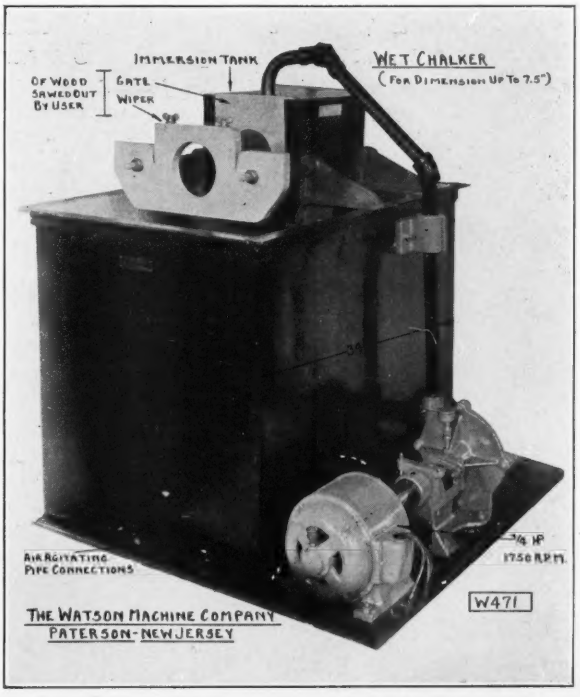
Wet Chalker duplicates our Submersion Compound Tanks in principle, the pump keeping the immersion tank overflowing, insuring thorough coating of the cable.

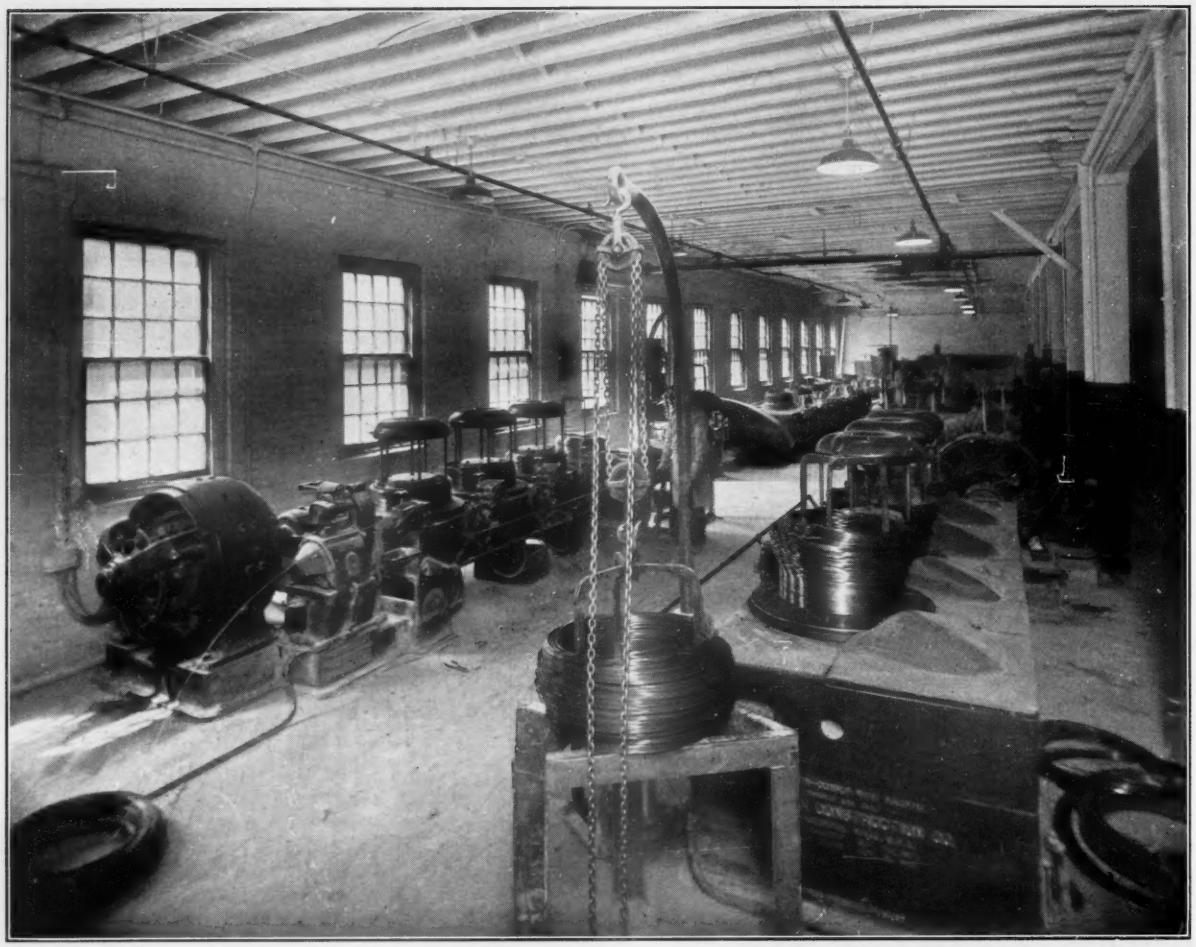
User provides wooden gates cut out on band saw with hole 0.25" over cable diameter at ends of immersion tank.

Pump and Motor for AC or DC current supplied.

Four air jet connections are provided in the tank for agitation.

Tank supplied to cable axial height above floor specified.





Section of Morgan-Connor Wire Machine department in the East Newark plant of Stewart Hartshorn Company, pioneers and the largest makers of shade rollers in the world. All shade roller wire (.80 carbon) processed on Morgan-Connor Wire Machines.

MORGAN CONSTRUCTION COMPANY

WORCESTER, MASSACHUSETTS

MALMEDIE & COMPANY, Dusseldorf, Germany
Sole Licensee for Morgan-Connor Wire Machines in Europe

MORGAN
WORCESTER

ENGINEERS AND MANUFACTURERS

ROLLING MILLS GAS PRODUCERS WIRE MACHINERY
COMBUSTION CONTROLS